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STUDIES ON SOUTH AMERICAN FRESH-WATER FISHES. I.

By George S. Myers

The Natural History Museum of Stanford University has amassed large collec-ns of South American fresh-water fishes, which together with the very extensive th American materials in the California Academy of Sciences, forms probably the est series available anywhere for the study of South American fluviatile ich-ology. The fishes obtained by the late Dr. Carl Ternetz in the Rio Negro, Canal Casiquiare and upper Rio Orinoco have been placed in my hands for study by the demy authorities and will be reported on in their publications. In reporting n the Stanford material, it seems best to adopt a serial form somewhat similar the manner in which Steindachner published so many of his South American papers. s is the first of that series, and consists of records and descriptions of new rare species culled from the large amount of material on hand.

The sources of the material now presented are chiefly three. For nearly nine rs Mr. William G. Scherer of the Evangelical Mission at Pevas, at the mouth of Rio Ampiyacu, Amazonian Peru, has been sending me extensive collections of hes. Nearly all the Siluroids have been carefully worked over by my student, William A. Gosline, and it is to be hoped that at least some parts of his paper them can be published. Many little-known or entirely new species are present, ecially among the smaller Characins. A few of the Scherer fishes are reported e.

When Dr. F. F. Bond, now of the University of Rochester, Rochester, New k, made a survey of methods of combatting malarial mosquitoes for the Venezuelan ernment, he studied the use of fishes in the control of mosquitoes, and as a by-duct assembled a fine collection of Venezuelan fishes, representing the fauna of rly all the important drainages north of the main course of the Rio Orinoco. collection was forwarded to Dr. Carl L. Hubbs of the University of Michigan, kept all the brackish-water fishes and Poeciliids and forwarded the remainder Stanford.

Venezuela has long been a terra incognita to the ichthyologist, and Dr. d's collections, like those of Ternetz from the upper Orinoco and Casiquiare, crowded with new genera and new species and with known forms hitherto unreport-from Venezuela. Of especial interest are the extensive series of fishes from streams of the Maracaibo drainage, known to us heretofore only from a few spe-s described over a hundred years ago by Cuvier and Valenciennes. Bond's col-tions show that the Maracaibo fauna is closely related to that of the lower Magdalena, but with a considerable endemic element, mostly of new species, and

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ring the absence of the Editor on sabbatical leave, the present and succeeding ues will be edited by Miss Margaret Storey.

a number of genera characteristic both of the Orinoco and of the Venezuelan highlands to the eastward.

Due to my approaching departure for Brazil it has been impossible to describe more than a handful of the new forms in the Bond collection, and many surprising things will be revealed before it is completely worked over.

The third lot that has contributed materially to the present paper is a small collection of Brazilian fishes sent me by Lt.-Col. Thomas D. White of the United States Army Air Corps, collected as aquarium fishes by himself and by Mrs. White while they were stationed in Rio de Janeiro. Many of the species were picked up by Lt.-Col. White at brief stops during flights to remote parts of Brazil. In this paper I have concentrated upon the Cyprinodonts, in which Lt.-Col. and Mrs. White took an especial interest while studying them in their aquaria in Rio.

Family CHARACIDAE

XENAGONIATES, new genus

Allied to *Leptagoniates* and *Phenagoniates* but differing sharply in the presence of a well-developed patch of strong teeth on each palatine and in the much more posterior dorsal fin. Anal very long and rather broad. Adipose present. Maxillary, premaxillary, and mandible each with a single, close-set series of small strong tricuspid teeth; each palatine with a patch of strong, blunt teeth. Dorsal origin situated much further from head than from caudal base. Lateral line complete.

Genotype *X. bondi*.

Xenagoniates bondi, new species

Holotype.—Stanford 36486; 52 mm standard length; collected on March 16, 1939, in the Rio Amana, 6 km. east of Santa Barbara and 35 km. west of Maturin, Venezuela, by Dr. F. F. Bond. (Coll. no. 125.)

Paratypes.—Three specimens, 37 to 52 mm standard length, from the same locality and on the same date as the holotype.

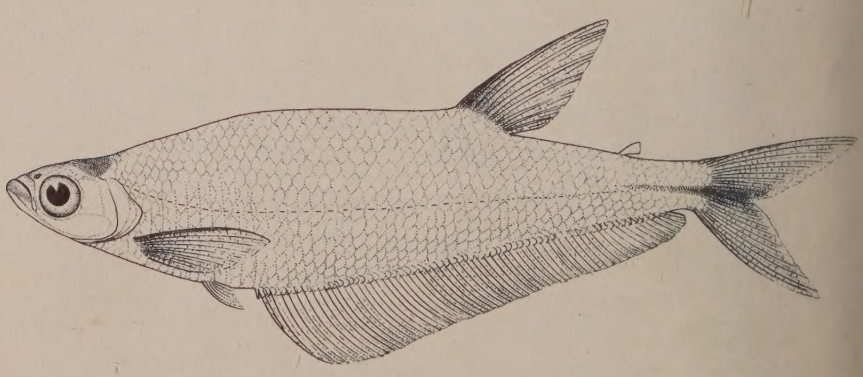


Fig. 1. *Xenagoniates bondi*. Holotype. Drawn by Pascual Ortiz.

Description.—Dorsal 10. Anal 63 to 66. Pectorals 13. Pelvics 7. The scales mostly lost on the types but count of scale-pockets gives 50 or 51 scales in decurved lateral line. Base of anal fin with a basal sheath of a series of les. Eye large, set low. Color pale yellowish. Occiput, first rays of pectoral, al part of first dorsal rays, and a median stripe through center of caudal pecle and caudal fin all are darkened with crowded melanophores.

This fish has been compared directly with specimens of *Phenagoniates* and *agoniates*. *Leptagoniates* is still known only from Boulenger's original description (Proc. Zool. Soc. London, 1887, p. 281, pl. 23) of *L. steindachneri* from Amaian Ecuador, and from a brief and doubtful record of aquarium specimens (Arnold Ahl, Fremländ. Süsswasserf., 1936, p. 89). The new genus is similar to *Phenaniates macrolepis* (Meek and Hildebrand, Field Mus., Zool. Ser., 1916, vol. 10, 15, p. 272; Eigenmann, Mem. Carnegie Mus., 1915, vol. 7, no. 1, p. 43, pl. 5) the large, low-set eye and conical muzzle. Both differ widely from *Paragoniates*, ich has long jaws and a very wide gape. It should be noted that the original elling of *Phenagoniates* must be retained. *Phenagoniates macrolepis* is rather mmon in the Maracaibo basin.

Probolodus heterostomus Eigenmann

Two fine specimens from the western end of the coastal plain of Rio were tained by Lt.-Col. and Mrs. White. The exact locality was a brook two or three les northwest of Itaquahy, State of Rio de Janeiro. Externally this fish is an act duplicate of an *Astyanax* inhabiting the same waters, and in working over the ite collection I had unhesitatingly put the two species in the same bottle. It s not until I had occasion to examine the teeth of the supposed *Astyanax* that discovered two of the fishes to be *Probolodus*. Once one opens the mouth the alst unbelievably strange dentition of this species can be recognized even with the ked eye.

Pseudocorynopoma heterandria Eigenmann

Hitherto known only from Xiririca, Rio Ribeira, São Paulo. Two fine specins were collected by Lt.-Col. and Mrs. T. D. White, one from the coastal plain ar the bay of Rio, the other from a deep sluggish creek, up to five feet in depth th bog plants on the edges, on the Rio de Janeiro-Belém road, approximately three les north of the new school of agriculture.

Diapoma speculiferum Cope

This strange genus has been known for half a century only through the single ale type specimen from Jacuhy, Rio Grande do Sul. The Marshall Field Expedition of ne Field Museum, Chicago, found this fish to be abundant in Uruguay. Through the ourtesy of Mr. K. P. Schmidt, the Stanford Museum has one small lot from Field useum's extensive series. Our specimens are from the Rio Cebollati, Departments of ocha and Minas, Uruguay, collected on November 29, 1926, by Colin C. Sanborn. Both exes possess the extended opercle, but the projection is shorter in the females nd does not bear the black edging seen in the males. Unfortunately all the specens are poorly preserved and have lost many of the scales.

Astyanax superbus, new species

Holotype.—Stanford 36489; a male, 85 mm standard length; small brook trib tary to the Rio Tamanaco (a tributary of the Rio Paye; Rio Portuguesa drainage) Camoruco, 20 km. northeast of San Carlos, Venezuela; March 9, 1938; Dr. F. F. Bon (Coll. no. 61.)

Paratypes.—A male and two females, 74 to 109 mm standard length, same pla and date as holotype.

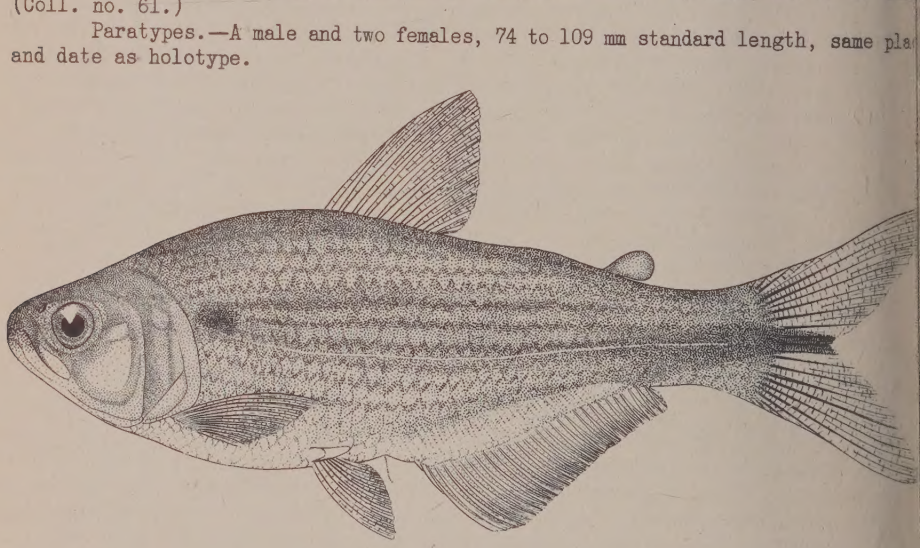


Fig. 2. *Astyanax superbus*. Male holotype. Drawn by Pascual Ortiz.

Description.—Head 4.1 to 4.6 in standard length, depth 2.7. Dorsal 10 Anal 29. Scales in lateral line 39 or 40; seven or eight scales above lateral lin series to dorsal origin, six or seven below to pelvic origin. Eye 3.3 (in a small male) to 4.1 (in a large female) in head length, 1.2 to 1.3 in bony interorbital.

Belly normally rounded, the midventral series of scales irregular, not com- plete, somewhat smaller than adjacent scales. Postventral area sharper. Predorsal area bluntly keeled, the squamation very irregular so that no special median series of predorsal scales can be made out; there is, however, no naked area. Counting to one side of the midline, about 15 scales are present between the dorsal and the tip of the occipital process. Occipital process bordered by four scales on each side.

Length of occipital process 3.5 in distance from its tip to dorsal fin. Great suborbital leaving a narrow to rather wide naked border both behind and be- low. Mouth large, the maxillary longer than the eye. Mandible 1.7 to twice length of eye. Five 5- to 3-pointed teeth in the inner row of each premaxillary, the cen- tral cusp largest; four 3- or faintly 5-cusped teeth of smaller size in the outer row of each side. Maxillary with five or six tricuspid, close-set, strong teeth at its proximal end. Mandible with four strong 5- to 3-cusped teeth in each side in front, followed by a graduated series of smaller teeth.

Gill-rakers 10 + 12, the longest nearly half length of eye.

Dorsal origin midway between snout-tip and tip of depressed adipose fin. Dorsal fin of normal form, not falcate, somewhat longer in males than in females,

longest ray in male equal to head length. Origin of anal fin slightly posterior base of last dorsal ray, its border nearly straight and its rays somewhat longer males than in females (the normal condition in the genus). Pelvics when appressed reaching slightly past vent in males, not quite to vent in females, reaching first ray of anal fin in neither sex. Origin of pelvics just before that of dorsal. Pectorals reach origin of pelvics in males but not in females.

Lateral line gently decurved anteriorly, nearly straight posteriorly. Anal with a basal sheath of one row of scales, the scale-rows above the anal with some interpolated scales, causing the rows to deflect downward.

Dusky, darker above, lighter beneath. All scales except those on belly with narrow dark border; besides this there are dark brown longitudinal lines between scale-rows; these longitudinal lines are confined mostly to the dorsal half of fish in females. In males, on the contrary, the lines are plain even rather low the belly, but they are less conspicuous than in the females since in the males pattern is obscured by a general darkening of the whole fish, and the presence a more or less well-developed longitudinal row of pinnate black marks down the dle of the side; these pinnate markings may, however, not appear. The pattern of males is much complicated also by the heavier dark edgings of the scales.

A rounded or horizontally ovate humeral spot without any accompanying light a. A wide dark shade through the caudal peduncle and through the midpart of the l to the ends of the middle rays. Fins otherwise dusky, unmarked, except for a k base and bordering seam on the adipose.

This species of *Astyanax* is close to a number of species in technical characters, but is abundantly different from all known forms. It evidently belongs the subgenus *Poecilurichthys* and may be close to *A. bimaculatus*, but it totally ks the distinctive humeral markings of *bimaculatus*. Its relationships may rest h *A. maximus*, since that species has similar counts and dorsal position, with a ilar caudal stripe and shade on the peduncle, and shows traces of the longitinal lines, at least in the material in the Stanford collection. The only other yanax with a similar color pattern is *A. lineatus*, from the Rio Paraguay system, ember of the subgenus *Astyanax*, but I do not think that species shows a colorain of combined lines and reticulated scale pattern.

Carnegiella marthae Myers

This species was described from Caño de Quiribana, at Caicara, Rio Orinoco, st below the mouth of the Rio Apuré. Later (1934, The Aquarium, Philadelphia, l. 2, no. 9, p. 217) I described the appearance and habits of two live aquarium ecimens sent me from Manáos, Amazonas, Brazil. The first photo of living specins, by Mr. W. T. Innes, was presented at the same time. I can now record the spees from Shansho Caño, at Pevas, on the Peruvian Amazon, whence Mr. W. G. Scherer s sent the Stanford Museum a specimen.

Parodon apolinari Myers

Ten small specimens, averaging 35 mm standard length, from the Rio Guarico El Sombrero, Guarico, Venezuela; Dr. F. F. Bond (Coll. no. 44). The species has itherto been known only from the type from the upper Rio Meta system in Colombia, ut there is now a large series of topotypes in the U.S. National Museum.

Exodon paradoxus Müller and Troschel

Lt.-Col. White obtained two fine adults of this Characin at Porto Nacional, io Tocantins, Goyaz, Brazil, on September 12-13, 1941. They were taken in the ain river.

Asiphonichthys stenopterus Cope

Two lots of this species are in the Stanford Museum, both in rather poor condition. One specimen was obtained by Dr. A. W. Herre in June 1934 at San Pedro, north of Buenos Aires, Argentina, and four in the same month from the Rio Paraguay in Entre Rios, Argentina.

Ctenolucius hujeta (Cuvier and Valenciennes)

Three specimens, the largest 139 mm, from Quebrada Sargento, tributary of the Rio Limón, north of the city of Maracaibo, Zulia, Venezuela; F. F. Bond (Coll. no. 98). This is the first time this fish has been recorded from the Maracaibo basin since it was described in 1849. It turns out to be identical with *Luciocharax insculptus* Steindachner 1878. The species reported by Bean (Proc. U.S. Nat. Mus., 1908, vol. 33, p. 701) as *C. hujeta* is actually *C. beani* (Fowler).

Family BUNOCEPHALIDAE

HOPLOMYZON, new genus

A new genus of Bunocephalinae adapted for life in swift water, with the head and maxillary barbels strongly resembling those of such hill-stream Nematognaths as *Exostoma* and *Astroblepus*.

Anal fin short, of 6 rays, originating under posterior part of dorsal fin, which has 7 rays. Caudal region of body, from origin of anal fin to base of caudal, somewhat less than half standard length. Vent much nearer to tip of snout than to caudal base, situated slightly anterior to middle of length of appressed pelvic fins. Pelvic fins originating far in advance of dorsal fin. Barbels 6, the two pairs of mental ones very small; the maxillary pair of barbels enlarged, each connected with side of head by a broad membranous web which extends to below the eye. Head depressed, the under surface of the head and body forming a plane surface. Dorsal surface gently rounded to dorsal fin. Widest at pectoral fin insertion, the body, from above, rapidly narrowing posteriorly; snout broadly rounded. Body in region of dorsal fin quadrangular in cross-section, somewhat deeper than wide, becoming much more slender and hexangular caudad. Peduncle slender. Head covered with the usual Bunocephalid rugosities, all of which are reduced save a median predorsal series which consists of an occipital bump and two median elongated elevations between this and the dorsal fin. Gill-openings inferior, placed as in *Xyliphius*. Mouth narrow, about equal to interorbital. Upper lip bearing four large papillae, the lower with neither papillae nor fringe. Humeral processes very short or absent. Coracoid processes even shorter, strongly curved inward, their tips placed immediately in front of and lateral to the origins of the pelvics. Pelvic spine curved, its membrane shaped much like that of *Exostoma* or *Glyptosternon*; outer (anterior) margin smooth, inner (posterior) surface with six large retrorse spines. The pectoral and pelvic fins are placed flat, in the plane of the ventral surface of the body.

Body armed with six longitudinal series of bony bucklers, the two dorsal and two ventral series large and strong, the two lateral-line series small and weak. The individual plates of the two dorsal and two ventral series are close together, becoming still closer posteriorly, the series of the right and left sides closing together behind the dorsal and anal fins to form a complete, flattened, bony armor above and below the tail. Skin faintly villiform on head and between the dorso-ventral armature and the small plates of the lateral-line series. The dorso-

tral series of plates form the four major angles of the body cross-section; teriorly they and the two lateral series form the six angles of the hexagonal l.

Genotype *H. atrizona.*

Hoplomyzon atrizona, new species

Holotype.—Stanford 36494; 27 mm standard length; collected on June 14, 1938 Dr. F. F. Bond, in a small, swift brook, tributary of the Rio Zulia, at Estacion hira (Estado Tachira), 60 km. north of San Cristobal, Venezuela; elevation about meters. (Coll. no. 105.)

Paratypes.—Five specimens; same locality data as holotype.

Description.—D. 7; A. 6; P. I,6; V. I,5. Upper series of scutes, from dor- origin to caudal base, 22 to 23. Lateral-line series of scutes about 50.

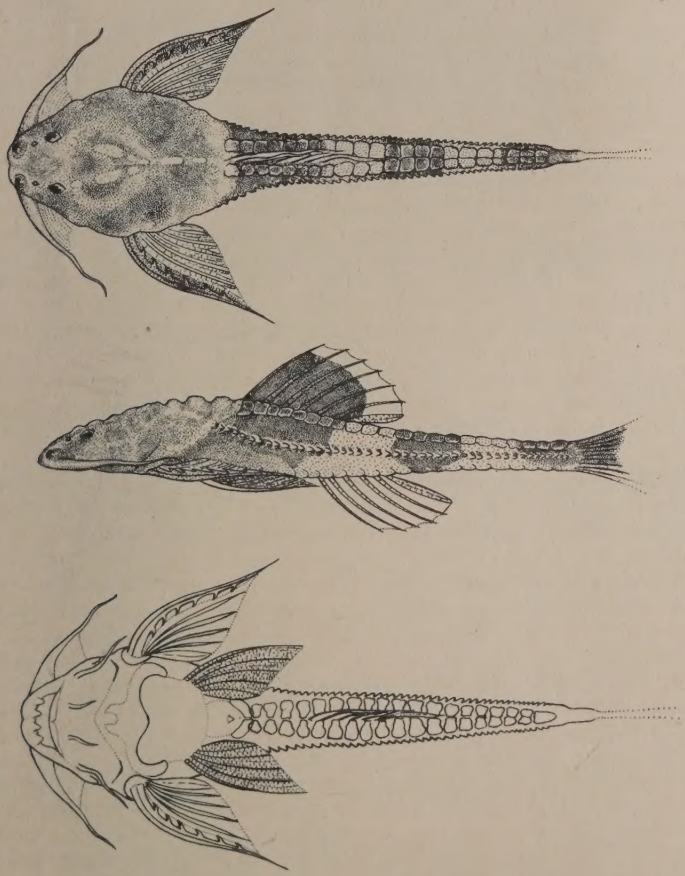


Fig. 3. *Hoplomyzon atrizona.* Paratype. Drawn by Pascual Ortiz.

Maxillary barbels reaching past middle of coracoid process. Membranous tips of pectoral spines reaching last fourth of length of pelvic fin. Pelvic fins reaching almost to origin of anal fin. Caudal apparently short; badly broken in all the type specimens.

Measurements of holotype in mm.—Standard length 27. Snout-tip to dorsal fin 11. Snout-tip to anal fin 15. Length head (to end occipital knob) 7.5. Greatest depth (at first of post-occipital elevations) 4. Greatest width (at pectoral insertion) 8. Orbit 1. Interorbital 2. Between first pair nares 1. Between second pair nares 2. Snout 3.

Body, venter, maxillary barbels, pectorals, pelvics, and anal pale clear yellowish. Upper surface of head, back to level of tips of humeral processes, dull mottled brownish. Three wide black crossbands, the first involving the anterior three-fourths of the dorsal fin and the body to below the lateral line, the second encircling the body at the end of the anal fin, and the third encircling the end of the caudal peduncle and the basal part of the caudal. These broad bands are very bold and striking.

Hoplomyzon atrizona has no known close relatives. The only genus which may be at all similar is *Xyliphius* Eigenmann 1912 (see Eigenmann, Mem. Carnegie Mus., 1923, vol. 9, no. 1, p. 27, pl. 1), known only from its insufficiently described and poorly figured type species, *X. magdalenae*, based on a single specimen from Girardot, Rio Magdalena, Colombia. *Xyliphius* has short humeral and coracoid processes, but not the flattened venter and webbed maxillary barbels. *Xyliphius* differs widely from *Hoplomyzon* also in the absence of bony plates, the shorter dorsal, the smooth head, the presence of a fringe of barbels on the lower lip, and the very differently placed fins. No other genus of Bunocephalidae seems to have bony armor and none approaches many of the other peculiarities of *Hoplomyzon*.

SYNOPSIS OF THE GENERA OF BUNOCEPHALIDAE

1a. Anal fin short, of 11 rays or fewer. (Bunocephalinae.)
2a. Body without lateral series of bony scutes; dorsal fin with 2 to 5 rays.
3a. Both sides of pectoral spine set with strong spines; dorsal fin with 5 rays; caudal peduncle slender.
4a. Head depressed, its greatest depth equal to about half its width ..... *Bunocephalus.*
4b. Head deep and extremely rugose, its greatest depth about equal to its width..... *Agmus.*
3b. Anterior side of pectoral spine relatively smooth.
5a. Dorsal fin with 2 rays; head very rugose, broad and depressed, its greatest depth less than the depth of the very deep caudal peduncle; lower lip not fringed..... *Bunocephalichthys.*
5b. Dorsal fin with 5 rays; head relatively smooth; caudal peduncle slender; lower lip with a fringe of fine barbels directed forward..... *Xyliphius.*
2b. Body with 6 longitudinal series of bony scutes, the 4 dorsal and ventral series forming a compact armor above and below the tail, the 2 lateral-line series formed of much smaller scutes; dorsal 7; pelvics originating before dorsal..... *Hoplomyzon.*
1b. Anal fin long, of 50 or more rays. (Aspredininae.)
6a. A series of barbels from the corner of the mouth along breast and anterior part of abdomen; maxillary barbel with a smaller barbel at its base.

. Tip of snout smooth, ethmoid without hooks; a single pair of mental barbels (rarely wanting).....*Chamaigenes.*
. Tip of snout (nasals and ethmoid) with 4 broad spines; a pair of mental and a pair of postmental barbels.....*Aspredinichthys.*
Breast and head not margined with barbels; maxillary barbel adnate.
. Maxillary barbel with a smaller barbel at its base.....*Aspredo.*
. Maxillary barbel without smaller barbel at base.....*Platystacus.*

The various genera of this family have been dealt with by Eigenmann in three s (Occ. Pap. California Acad. Sci., 1890, no. 1; Mem. Carnegie Mus., 1912, vol. nd Mem. Carnegie Mus., 1923, vol. 9, no. 1). Miles has redescribed *Xyliphius* his issue of the present journal (see below).

Family DORADIDAE

Agamyxis albomaculatus (Peters)

Agamyxis flavopictus Steindachner, from the Peruvian Amazon, is a synonym of species, which Ternetz collected in abundance in Caño de Quiribana, at Cai-, Rio Orinoco, Venezuela.

Entomocorus benjamini Eigenmann

This species, hitherto known only from the upper Madeira system, was col-ed by Dr. Bond in Venezuela. He obtained one specimen of 44 mm from Laguna El imo, 3 km. west of San Fernando de Apuré, Venezuela (Coll. no. 55).

Family AGENEIOSIDAE

Ageneiosus caucanus Steindachner

One specimen of 120 mm from a river tributary to the east side of Lake Mara-o, 10 km. south of Lagunillas, Venezuela; Dr. F. F. Bond (Coll. no. 90).

Family PYGIDIIDAE

Apomatoceros alleni Eigenmann

Mr. Scherer has sent us two large examples of this strange parasitic catfish a Pevas, Amazonian Peru. It has been known only from the type, now in the Cali-ia Academy of Sciences.

Acanthopoma bondi, new species

Holotype.—Stanford 36498; 36.5 mm standard length; Rio Apuré at San Fer-lo de Apuré, Venezuela; February 16, 1938; Dr. F. F. Bond (Coll. no. 53).

Paratype.—One very small specimen; Rio Guarico at El Sombrero, Venezuela; ruary 10, 1938; Dr. F. F. Bond (Coll. no. 44).

Description.—Dorsal 9. Anal 6. Head 6 in standard length, depth 7.5. Eye in head, longer than snout, almost twice as long as interorbital. The maxillar fossa, above the barbel, is very deep, and its superior fold (which is not deep reaches the lower border of the eye. There are at least three (or perhaps four even rows of fine teeth on the roof of the mouth, but I cannot make out any teeth on the inside of the upper lip. Lower jaw with three or more rows. Opercle with five spines, interopercle with six or seven.

Origin of dorsal fin midway between caudal base and origin of pectoral fin. Anal origin below end of dorsal base. Pelvic origin before dorsal, midway between caudal base and anterior border of eye. Two bands of granulated adipose tissue along sides to above anal fin, confluent anteriorly behind pectoral. Caudal very slightly emarginate, rather broad when spread.

Colorless except for a short median shade through center of peduncle, a tiny spot at caudal base, and a faint band through middle of caudal fin.

The genus *Acanthopoma*, differentiated from its close relatives by the freedom of the connected gill-membranes from the isthmus, has hitherto been known only from the single type specimen of *A. annectens* from the Rio Huallaga, formerly in the collection of Prof. Leuckart and now probably lost. The new species differs widely in the more anterior positions of the dorsal and anal fins, but is otherwise rather similar.

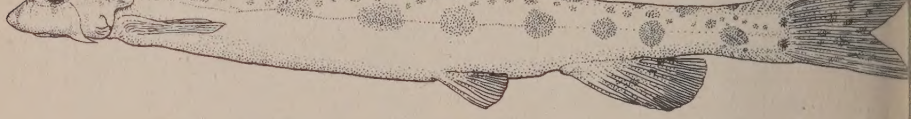


Fig. 4. *Homodiaetus haemomyzon*. Holotype. Drawn by Helen Nojiri.

Fig. 5. *Acanthopoma bondi*. Holotype. Drawn by Helen Nojiri.

Homodiaetus haemomyzon, new species

Holotype.—Stanford 36500; 57 mm standard length; Rio Guarico at Calabozo, Venezuela; February 12, 1938; Dr. F. F. Bond (Coll. no. 48).

Paratypes.—Three specimens, same data as holotype; one specimen from the Rio Guarico at El Sombrero, Venezuela, February 10, 1938 (Coll. no. 44); five specimens from lagoon 10 km. south of San Fernando de Apuré, Venezuela, February 17, 1938 (Coll. no. 55). Dr. F. F. Bond.

Description.—Head 5.7 in standard length, depth 7. Dorsal 9. Anal 6. Head slightly broader than long. Eye 3.6 in head, interorbital .6 eye. Opercle with 9 or 10 spines, interopercle with 7 or 8. Upper jaw with six distinct, widely separated, very even single rows of very tiny teeth; two of the rows are on the inside of the upper lip and four on the roof of the mouth. Lower jaw with three similar rows and none on the lip.

Axillary gland not conspicuous. Origin of dorsal fin midway between snout- and tip of caudal fin, slightly posterior to origin of pelvic fins, which is way between caudal base and origin of pectoral fins. Caudal somewhat emarginate, the tips slightly more rounded than is shown in the drawing, when the fin is ead. Accessory procurrent caudal supporting rays relatively well developed, e so than in *H. maculatus* but much less so than in *H. anisitsi*.

Fig. 6. *Corydoras septentrionalis*. Holotype. Drawn by Pascual Ortiz.

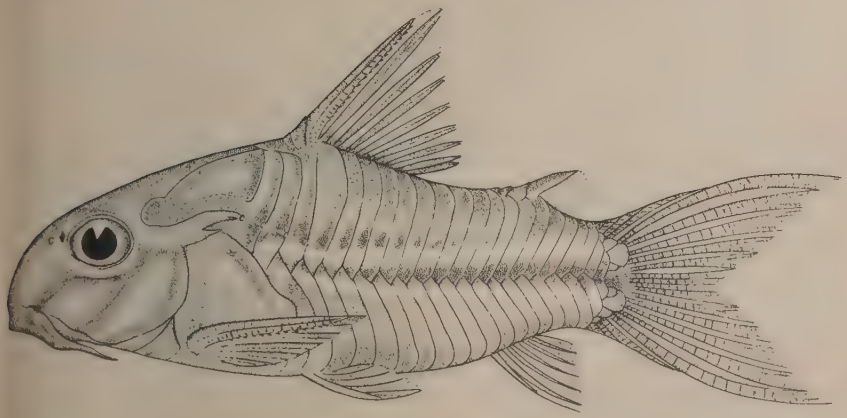


Fig. 7. *Corydoras bondi*. Paratype. Rio Carichapo. Drawn by Pascual Ortiz.

Body pale, a little darker above. A series of 7 to 10 large rounded dark ots down middle of sides, the anterior ones faint and the last sometimes broken to two smaller spots at caudal base. Dorsum rather heavily sprinkled with smaller rk spots. Pectorals and pelvics plain. Dorsal, caudal, and sometimes anal irregu- rly marked with small dark spots.

This species is very different from *H. anisitsi* in the fewer procurrent cau- l rays, the much more posterior pelvic fins, and the color. It is much closer to

H. maculatus and it is probable that these two species are as closely related *Stegophilus* as they are to *Homodiaetus*. However, *H. haemomyzon* differs in pel position and many other characters from the rather similar-appearing *S. septentr onalis*. From *H. maculatus*, of southeastern Brazil, it differs in the fewer rows teeth, the more conspicuous and numerous procurrent caudal rays, and the more p terior pelvic fins. We may note that *Pseudostegophilus scarificator* von Iher 1930 belongs to *Homodiaetus* and should stand as *Homodiaetus scarificator*. It d fers from *maculatus* in the pelvic position and from *haemomyzon* in the fewer rows mandibular teeth, the shorter head, the greater depth, and the different co pattern; in *scarificator* the median spots are smaller and there are very few of smaller spots on the dorsum.

Family CALLICHTHYIDAE

Corydoras bondi Gosline

This Venezuelan species, described by Dr. Gosline in no. 1 of the prese volume, is now figured from a paratype (Stanford 35068).

Corydoras septentrionalis Gosline

This Venezuelan species was also described by Dr. Gosline in no. 1 of t present volume, and is herewith figured from the holotype (Stanford 35055).

Family LORICARIIDAE

Cheiridodus hondae (Regan)

This fish has been known only from the Magdalena and San Juan basins Colombia. Dr. Bond obtained two small examples from the Rio Monay, 35 km. nor of Trujillo, Motatan system, Venezuela, on March 14, 1938, together with *Sturiso festivum*, a new *Loricaria*, a new *Lasiancistrus*, and some other Loricariids a undescribed Characins.

Sturisoma festivum, new species

Holotype.—Stanford 36505; an adult male 169 mm standard length; Rio Mona 35 km. north of Trujillo, Motatan system, Maracaibo basin, Venezuela; March 1 1938; Dr. F. F. Bond (Coll. no. 73).

Paratypes.—Nine specimens, males, females, and young; same place and da as holotype.

Description.—Rostrum present, snout 1.66 in head. Eye 8.2 in head length adults. Lateral scutes 31. All fins with initial spine or ray greatly elongated filamentous, the upper and lower caudal rays similarly elongated. The pectora spine thus extends far beyond the middle of the appressed pelvic fins; in males may extend past the tips of the filamentous pelvic spines. The fin-spines are jus as elongate and filamentous in the young of 74 mm standard length as in most the adults. Breadth of body of adults at level of base of last anal ray 5.15 t

Fig. 8. *Sturisoma festivum*. Male holotype. Drawn by Pascual Ortiz.

Fig. 9. Same, underside of head.

Fig. 10. Adult female, underside of head.

5.25 times in length from that point to caudal base. Sides of posterior part snout and cheeks of the males with a thick growth of bristles.

Head 4.9 to 5 in standard length. Breadth of head 1.4 to 1.5 in its leng interorbital 2.6 to 2.7. Lateral keels not becoming obsolete until within one two scutes of head, becoming confluent on the fifteenth or sixteenth scute. dominal scutellation very variable, normally with two series of plates between lateral bucklers posteriorly, and three series anteriorly. Anal plate bordered teriorly by three or exceptionally two scutes, and these usually by five.

Brownish, somewhat mottled with lighter. Pectorals, pelvics, anal, and c dal obscurely cross-banded or mottled, the prolonged filaments banded with da Base of dorsal dark, an irregular dark stripe running from the base to the along the first few soft rays. A young example is very prettily marked, havin wide dark lateral band from the sides of the snout, through the eye, and fad posterior to the anal fin; below the dorsal the lateral band gives off anot band which runs up to the anterior dorsal base and out upon the anterior soft r to the tip of the fin.

Closely related to *S. panamense* and *S. frenatum* (which Meek and Hildebra synonymize with *panamense*), but differing in proportions and in the greatly pr longed fins.

Farlowella acus (Kner)

Forty specimens from the Rio Amana, 6 km. east of Santa Barbara, Monag Venezuela, in the Rio Guanipa drainage; Dr. F. F. Bond (Coll. no. 125).

Farlowella kneri (Steindachner)

A single large specimen collected by William Clarke-Macintyre in the R Cotopino, eastern Ecuador, in January, 1939.

Farlowella curtirostra, new species

Holotype.—Stanford 36508; 93 mm standard length; Quebrada Tabor, tribut of the Rio Motatan system, 30 km. north of Trujillo, Maracaibo basin, Venezue March 14, 1938; Dr. F. F. Bond, collector.

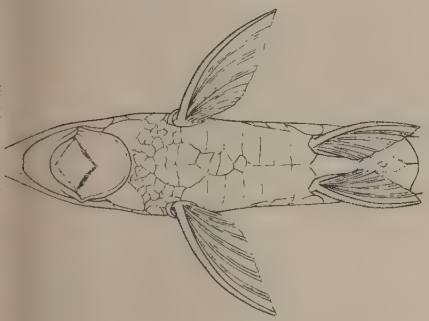
Paratypes.—Fourteen specimens: two smaller specimens from same locality the holotype; and 12 others from the Rio Monay, 35 km. north of Trujillo.

Description.—Differs widely from all known species in the exceptional short snout. Profile of snout from above with only slight concavity at the sid the rostral tip bluntly rounded and about as broad as the orbit. Length of sn (measured from anterior margin of oral depression to tip of rostrum) 9.3 to times in distance from tip of rostrum to anus. Length of oral depression 3.4 tim in same distance. Length of head (snout-tip to end of opercle) 5.3 in standa length; distance from supraoccipital to dorsal 5.3 in same.

Scutes 33. Dorsal I,6. Anal I,5. Pectoral I,5. Pelvic I,5. Pectorals falli one scute short of pelvics, which reach end of anal depression. One row of scut between suborbital-preorbitals and the circum-oral ring. No bristles on snout side of head of any of the type series. Color dull brown, lighter below; caud with a dark longitudinal bar above and below.

Measurements of holotype in mm.—Standard length 93. Rostral length 3.5. ut-tip to anus 34. Length of oral depression 10. Interorbital 5.5. Head length end of operculum 17.5. Supraoccipital to dorsal fin 22. Breadth of head at oper- s 8.5. Orbit to tip of snout 13.5. Orbit 2. Length of first dorsal ray 13. First l ray length 13. Length caudal 13. Length first pelvic ray 8. Length pectoral . 11.

Regan (Trans. Zool. Soc. London, 1904, vol. 17, p. 302) and Eigenmann and .ce (Ann. Carnegie Mus., 1917, vol. 11, p. 297) utilize the presence or absence a median series of ventral abdominal scutes as a character to break up the spe- s of *Farlowella* into two groups. The type series of *F. curtirostra* shows every iation from a complete median series of scutes to the absence of all save one erior median scute.



g. 11. *Farlowella curtirostra*. Paratype. Drawn by Pascual Ortiz.

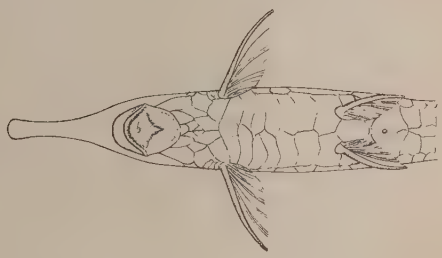


Fig. 12. *Farlowella vittata*. Holotype. Drawn by Pascual Ortiz.

Farlowella vittata, new species

Holotype.—Stanford 36512; 141 mm standard length; tributaries of the Rio ibanto, from San Cristobal to the llanos, Venezuela; Dr. F. F. Bond, collector; ne 15, 1938.

Paratypes.—Six specimens; 41 to 125 mm; same locality data as holotype. e smallest paratype has not been utilized for the description.

Description.—None of the specimens with a median series of plates on the domen. Head 4 in standard length. Snout relatively long and slender, its length om the anterior border of the oral ring 3.3 to 3.6 in the length from snout-tip anus. Distance from end of occipital plate to origin of dorsal fin 5.20 to 5.25 standard length, the occipital plate separated from dorsal fin by eight plates. terorbital 4.5 in head length. Eye slightly more than 3 in interorbital. Post- bital length of head 2.66 in length of snout from oral ring. Side of head without istles. Scutes 34, the anus in the seventh body ring and the origin of the anal n after the ninth ring. Outer caudal lobes produced, each lobe with a marbled rk longitudinal stripe. Body brownish, with a broad, deeper brown band on each de from rostrum, including eye, and losing itself after the dorsal and anal fins.

Allied to *F. amazona* Günther and *F. pleurotaenia* Miranda Ribeiro, but dif- ring greatly in many proportions of snout, head, and body length.

Family CYPRINODONTIDAE

Notes are herewith presented on some of the least known South American fo and I have taken this opportunity of figuring a number of them. The additio material now at hand renders a revision of my 1927 review of the Neotropical gene imperative, and it is hoped that a new revision may be done before long.

Of especial interest are the many new *Cynolebias* discovered by Lt.-Col. a Mrs. White in the coastal plain of the State of Rio de Janeiro. The fishes of th genus are now known, through the work of aquarists and aquarium collectors, to annual fishes which complete a full life cycle within one year. They are rare absent in ordinary streams and permanent lakes and ponds, being common only isolated water holes, swamps, and puddles that dry up in the dry season. The fish require a deep mud bottom. The eggs, which are very tough-shelled and resistan are deposited in the mud when the ponds have begun to dry up. The adult populat is wiped out upon the complete drying of the ponds and the species exist over t dry season only in the egg stage, buried in the damp mud under the hardened to crust. Advent of the wet season, with accumulation of water in the ponds and t softening of the mud, initiates the hatching of the eggs. Development of the fry exceedingly rapid, for in some instances full growth is attained in two or thr months.

Old adults taken towards the end of the aquatic part of the life cycle m sometimes be held over alive for several months, or perhaps a year or more, aquaria, but all who have kept these fishes alive agree that they are very shor lived. Certain African species, *Aphyosemion caeruleum* for one, as well as sever species of *Nothobranchius*, also are short-lived, and produce tough eggs which, the few instances in which the fishes have been bred, have been found to take o to several months to hatch. It is probable that these species, especially *Noth branchius* from the drier plains of East Africa, are annual fishes. It will be not that the species of *Nothobranchius* resemble *Cynolebias* not only in the deep compa body but also in the exceedingly brilliant colors of the adult males. It will noted also that the specialized habitat and the seasonal occurrence of *Cynolebi* makes the genus one that is seldom seen by the ordinary ichthyological collector and specimens seldom fall into the hands of ichthyologists save through the co mercial aquarium fish collectors. Lt.-Col. and Mrs. White are therefore to be con gratulated upon the collection they have made. They specialized upon the Cyprino donts while stationed in Brazil and sought out and collected the various species often only by the expenditure of great effort, in order to study them in the aquaria in Rio. It is to be hoped that Lt.-Col. White will some day be able prepare for publication his extensive notes on the habits and ecology of the vari ous species.

Only one of Lt.-Col. White's species is a typical, deep-bodied *Cynolebias* That one is *C. constanciae*. The others are slender species that would seem to closer to *Cynopoecilus*. As a matter of fact the discovery of these five slende species may make it impossible to maintain the genus *Cynopoecilus*, since the char acter of the separation of the pelvic fins does not now seem to be of much impor tance. I have seen only one example of the genotype of *Cynopoecilus* (*C. melanotae nia* Regan) and that is a male now in the U.S. National Museum. The species is fro near Paranagua, the exact locality from which the types were obtained being state by Rachow (Handbuch der Zierfischkunde, Stuttgart, 1928, p. 101) to be Quinta, nea Paranagua, "in einem zirka 120 qm. grossen und $\frac{1}{2}$ - 1 m. tiefen Tümpel, der klare Wasser entheilt und teilweise mit einer Myriophyllumart bewachsen war." Rach

plied Regan with the type specimens. Until I can see good new material of *mela-*
genia I prefer to leave the status of the genus *Cynopoecilus* doubtful, but I
spect it to be an annual fish close to or not generically separable from *Cyno-*
bias. The five new slender species here described are placed in *Cynolebias*, since
fail to find valid characters to separate them from that genus. In *whitei*, at
st, the females are unmistakably members of the genus *Cynolebias* in their color
tern and form, even though more slender. Miranda Ribeiro has described one "*Cy-*
poecilus" from the base of the Serra do Petropolis (see below under *C. whitei*)
it may be identical with one of the smaller of my species, but I cannot be
e without seeing the types. I have also referred below to a supposed *Cynopoe-*
lus mentioned in a popular aquarium book, which I refuse to recognize. Other-
se, no other slender-bodied *Cynolebias* or *Cynopoecilus* have been known.

Cynolebias constanciae, new species

Holotype.—Stanford 36514; a small adult male, 36 mm standard length; from a
er hole for cattle, 10 miles north of Cabo Frio, State of Rio de Janeiro, Bra-
.; May 12, 1941; Lt.-Col. and Mrs. T. D. White, U.S.A. The hole was approxi-
ely 20 feet in diameter with a maximum water depth of three feet standing over
feet of soft black mud; hair-grass was growing in the water, which was slightly
ty to the taste; ocean about four miles away; no streams in the vicinity.

Paratypes.—An adult female, 45 mm standard length, and two young examples;
me place and date. As I understand it, both of the adult types were of the size
the smaller of the two young when collected, and were allowed to mature in Lt.-
l. White's aquaria in Rio.

Description of male.—Dorsal 15. Anal 22. Scales in lateral series 27. Elev-
transverse scales from dorsal origin to pelvics. Predorsal scales to between
es 17. Scales around peduncle 12. Head 3.95 in standard length, depth 2.85. Eye
in head, 1.3 in interorbital. Snout shorter than eye. Dorsal origin over base of
ghth anal ray. Base length of dorsal equal to head length. Base length of anal
ightly more than twice in length of body without head. Caudal rounded.

In alcohol pale yellowish white, darker on back, with three longitudinal
ws of spots of about the size of the pupil running down the sides, the middle
w beginning at the upper angle of opercle and ending at middle of caudal base;
me of the spots in each row run together to make the row a partial stripe, and
ere is an indication of a fourth row below the third, on the belly. Dorsal and
al fins with spots of about the same size; caudal with smaller spots.

A color sketch from life shows almost the entire body and vertical fins to
vivid metallic blue-green, especially brilliant on the opercles, the spots black
d the iris yellow. The edge of the anal is suffused with blackish. The sketch
so shows the dorsal fin as pointed at the tips of the eighth or ninth dorsal
ys, and these rays produced as filaments reaching as far as the end of the cau-
l. Lt.-Col. White tells me the holotype had these produced rays in life but lost
em.

Description of female.—Dorsal 14. Anal 21. Lateral scales 27. Transverse
ales 11. Predorsal scales 20. Scales around peduncle 14. Head 3.5, depth 2.7, in
andard length. Eye 3 in head, 1.4 in interorbital. Snout shorter than eye. Dorsal
igin over base of sixth or seventh anal ray. Base length of dorsal slightly
orter than head. Base length of anal a little more than twice in body without
ad. Caudal rounded.

In alcohol the pale ground color is almost completely hidden by close-set

dark spots of variable size, but mostly about equal to pupil. Some indication o the three rows of spots of the male can be seen on the rear part of the sides, an there is a darker mid-side spot as in female *C. belottii*. The spots of the fins ar like those of the male, but darker and closer together.

A color sketch from life shows the single darker mid-side spot doubled (a often happens in female *C. belottii*) and blue in color, while all the other spot are dark. The ground color is yellowish where visible, especially on the fins. Th iris is shown as a red-brown color.

According to Ahl's latest synopsis of the genus (Zool. Anz., 1934, vol. 108 p. 305) this species is allied to the large-scaled group containing *belottii*, ad *loffi*, and *nigripinnis*. To this group also belongs *C. irregularis* Ahl (Zool. Anz. 1938, vol. 124, p. 57), but none of these four species has as low a dorsal coun as *constanciae*, nor do the males of any (where males are known) approach this ne species in color pattern. Also, this is the northernmost representative of th large-scaled group; and if my suspicion is confirmed that the locality of *C. pora sus* (Pernambuco) is incorrect, it is the northernmost species of the genus. Lt. Col. and Mrs. White found this fish only in the one water hole, and obtained onl a very few specimens.

I take pleasure in naming this beautiful little fish after Mrs. White, wh helped her husband in his collecting, and made many of the water color sketche sent me.

Cynolebias whitei, new species

Holotype.—Stanford 36516; an old male, 48 mm standard length; from a dryin swamp 10 or 12 miles north of Cabo Frio, State of Rio de Janeiro, Brazil; August 2 1941; Lt.-Col. and Mrs. Thomas D. White. The swamp was filled with a high growth o dense reeds and grass. The fish, which were apparently at the very end of the life cycle, were found in dense masses in the small, rapidly drying pools and puddles some only a foot in diameter. The actual types were in water two to six inches deep. This species was found in several near-by places, as well as in other mud-bottom ponds nearer the city of Rio de Janeiro.

Paratypes.—Nine adults, male and female, with same data as holotype, the largest female being 44 mm standard length; also four adults from same place, col lected on May 12, 1941.

Description of male.—Dorsal 15 or 16. Anal 20 to 23. Lateral scales 29 or 30. Transverse scales between dorsal origin and pelvics 11. Predorsal scales 15 to 18. Scales around peduncle 12 to 16, the number frequently uneven. Head 3.95 to 4.3 in standard length, depth 3.8 to 4. Eye 3.6 to 4 in head, 1.6 to 1.8 in interorbital. Snout about as long as eye. Dorsal origin over base of ninth anal ray, somewhat behind middle of standard length. Base length of dorsal 3 in standard length without snout. Base length of anal about twice in body length without head. Caudal rounded. Dorsal and anal pointed.

Color in alcohol dull brown, with traces of small light spots on some of the scales. Fins dusky. Anal with a pinkish intramarginal band and a thin black edging.

Two color sketches of adult males in full color show the whole body and all the fins (even the pectorals) red-brown to a brownish plum. The pectorals and pelvics have no other color. The dorsal and especially the caudal and anal are heavily sprinkled with small intense blue-green spots, the caudal with a blue-green marginal or intramarginal band, and the anal with a salmon pink to orange intramarginal band. This band bounded proximally with narrower yellow or yellow-green

d. Body with 15 or more rather regular vertical rows of small blue-green spots. rcles blue-green. Iris yellowish, a dark vertical bar through it.

Description of female.—Dorsal 14. Anal 18. Scales lateral 32. Scales trans- se 11. Predorsal scales 20. Scales around peduncle 14. Head 3.8 in standard gth, depth 3.8. Eye 3.5 in head, 1.5 in interorbital.

Color in alcohol typical of *Cynolebias* females. About 15 wide dark cross- s on body, wider than interspaces, with a single or double mid-body darker spot, frequently a similar spot or spots at caudal base. Sides of head spotted or red. Dorsal, anal, and caudal covered with fine dark spots along the lines of rays. In some specimens these fin-spots are absent and the body-bars are light- these may be intersexes.

A color sketch, made from life, shows the mid-side and caudal base spots ck, the bars dark brown, and the light ground color tinged with yellowish and kish. Iris red-brown. Opercles tinged with green. Fins all very pale yellowish en.

This is the largest and commonest of the *Cynopoecilus*-like species of the stal plain of the State of Rio de Janeiro. The males do not have red spots or k bars on the vertical fins, nor do they have red bars or a yellow stripe on the y. The females are very strongly marked. In all these points the species differs ongly from the four smaller *Cynopoecilus*-like species of this area. This species perhaps be the same as *Cynopoecilus sicheleri* Miranda Ribeiro (Boletim Biolo- o, 1939, N.S., vol. 4, no. 3, p. 363) described from near Serra do Petropolis, I cannot place that species exactly in this difficult group without re-exami- ion of the types. I rather suspect that *sicheleri* is actually one of the smaller cies, perhaps one Lt.-Col. White did not obtain.

Named for Lieutenant-Colonel Thomas D. White, United States Army Air Corps rmerly of the Missão Americana de Aviação Militar no Brasil), in recognition his painstaking collection and investigation of the smaller fresh-water fishes the vicinity of Rio.

Cynolebias opalescens, new species

Holotype.—Stanford 36521; an adult male, 30 mm standard length; from water es or ponds along base of the Serra do Petropolis, State of Rio de Janeiro, zil, in the same vicinity and sometimes in the same ponds as *C. zingiberinus splendens*; June 1, 1941; Lt.-Col. and Mrs. T. D. White.

Paratypes.—Six adult males and three adult females, same data as holotype. under *C. zingiberinus* for description of type locality.

Description of male.—Dorsal 11 or 12. Anal 16 or 17. Lateral scales 25 or Transverse scales 8. Predorsal scales 18. Scales around peduncle 12. Head 3.8 standard length, depth 4. Eye 3 in head, 1.2 in interorbital. Snout shorter than e. Dorsal origin over base of fifth or sixth anal ray, midway between base of dal and preopercle. Base length of dorsal four times in length of body, without d. Base length of anal three times in body length posterior to middle of eye. dal rounded. Dorsal and anal pointed.

Color in alcohol plain dusky, lighter on the belly, vertical fins darker.

A crayon sketch of a live adult male shows the whole body as gleaming opal- cent, the scale-pattern faintly outlined in reddish pink, with blue and yellow- green reflections on the scales. Iris yellowish green with a vertical dark line rough it. Opercles with green and greenish yellow reflections. Dorsal iridescent h red, yellow and green, the edge darker; anal similar. Caudal similar, fading paler distally, the outer edges darker.

Description of female.—Dorsal 13. Anal 19. Dorsal and anal count similar in three females. In this species the female's anal fin is higher (with longer rays) than the male's anal, as is usual in the deep-bodied, more typical species of *Cynolebias*, a characteristic much more pronounced in this form than in *whitei*. Lateral scales 27. Transverse scales 9. Predorsal scales 19. Scales around peduncle 12. Head 3.6 in standard length, depth 3.7. Dorsal origin over base of sixth anal ray, just about midway between head and caudal base. Base length of dorsal four times in body length, without head. Base length of anal three times in same distance. Caudal rounded. Dorsal and anal somewhat pointed.

Color in alcohol plain dull gray-brown, neither the body nor the fins marked in any way save for the slightly darker scale-pockets.

This species differs from the others in the unspotted coloration (both in life and in alcohol), in the fin positions, and in the remarkable fact that the fin counts of the females are higher than those of the males.

Cynolebias zingiberinus, new species

Holotype.—Stanford 36523; an adult male, 24.5 mm standard length; from an isolated depression filled with water only during the rainy season, along the base of the Serra do Petropolis, State of Rio de Janeiro, Brazil; 1941; Lt.-Col. and Mrs. T. D. White. There are seepages from the Serra here and the fish are occasionally found in these as well as in the isolated pools. The locality is from one to three miles east on the old Petropolis road after the old road turns off to the right away from the new paved highway to Petropolis. The isolated pools are heavily matted with dead twigs, leaves, grass, and a species of *Myriophyllum*-like water plant. Water depth three inches to two feet.

Paratypes.—Ten adult males of about the same size as the holotype and a little smaller, from same locality as holotype.

Description of male.—Dorsal 13 or 14. Anal 16 or 17. Lateral scales 28 or 29. Transverse scales between dorsal origin and pelvics 10. Predorsal scales to between eyes 18. Scales around peduncle 14. Head 3.75 in standard length, depth 3.8. Eye 3 in head, 1.3 in interorbital. Snout shorter than eye. Dorsal origin over base of second to fourth anal ray, midway between the rear border of the pupil, the rear border of the eye, or a point slightly behind the eye, and the caudal base. Base length of dorsal a little more to a little less than three times in body without head. Base length of anal about three times in length from hind border of eye to caudal base. Caudal rounded. Dorsal and anal with pointed tips.

In alcohol the body is blackish posteriorly, fading imperceptibly until the body anterior to the pelvics is fairly light. Down the length of the body there are two light lines, one at or near the midline, the other lower, the upper line usually irregularly interrupted and the lower one always so. In some examples there is a trace of a third line above the other two. These light lines contrast strongly with the dark posterior ground color of the body. Dorsal light, with a thin dark margin and a few small dark spots. Anal with a heavier dark edge and similar spots. Pectorals and pelvics uncolored. Caudal mostly blackish, paler distally, with a thin black seam along its lower edge bordered within by a broad intramarginal white band. This intramarginal light band in the lower part of the caudal fin is a striking characteristic of all the males.

A water color sketch of an adult male shows the whole body a beautiful red-brown (like light, preserved ginger), darker dorsally and lighter ventrally. Dorsal, anal, and most of caudal a paler red-brown, covered with small bright red

ts. Lower seam of caudal black, the intramarginal band bright canary-yellow. The ght longitudinal stripes are bright canary-yellow, as are some of the specklings the cheeks.

This is the "ginger-griffin" of Lt.-Col. and Mrs. White's collection, and it a remarkably distinctive and beautiful fish. The females are very plain colored, l Lt.-Col. White was unable to distinguish them in life from the females of *C. endens*, a species which is frequently found with *zingiberinus* in nature. He sent therefore, a number of females which may belong to either of these two species. ey are dull brownish with indications of dark bars.

Ladiges (Tropical Fishes, Hamburg, 1934, p. 104) has mentioned and very rly figured a supposed *Cynopoecilus* which may possibly be the "ginger-griffin," since he gives no scientific description and the account is published in an nemeral popular aquarium book with no scientific circulation, I refuse to recog- ze the specific name he applies.

Cynolebias minimus, new species

Holotype.—Stanford 36525; an adult male, 20 mm standard length; from stand- g water in a cane-brake along the road to Rio, one mile east of Itaquahy (ap- rently a little west of the boundary of the Districto Federal), State of Rio de neiro, Brazil; summer (June, July, or August) of 1941; Lt.-Col. and Mrs. T. D. ite. The cane-brake was thick and the fish were on the south side of the road in l water in the brake, six to eighteen inches deep.

Paratypes.—One adult male and three adult females, all slightly smaller an the holotype, from the same locality. The females were taken with the males, l presumably belong here, especially in view of the size.

Description of male.—Dorsal 13. Anal 17. Lateral scales 26. Transverse les 9. Scales around peduncle 10. Head 3.7 in standard length, depth 4. Eye 2.8 head, 1.4 in interorbital. Snout shorter than eye. Dorsal origin over base of rth anal ray, midway between preopercle and caudal base. Base length of dorsal r times in distance from preopercle to caudal base. Base length of anal three nes in same distance. Caudal rounded. Dorsal and anal pointed.

Color in alcohol plain yellowish brown, the scale-pockets darker and the rtical fins flushed dark. The caudal bears a number of narrow, semicircular or e-like light bands, the convex side towards the fin-base and similar curved lines onvex side anteriorly) run from the base to the edges of the dorsal and anal ns.

A color sketch from life shows the brown body flushed with dark red and ree oblique dark red bands across the blue-green opercles. Paired fins yellowish. rtical fins intense dark blue-green, the lines visible upon the alcohol speci- ns being intense dark red or maroon in life.

Description of female.—Dorsal 13 or 14. Anal 17 or 18. Lateral scales 24 or . Transverse scales 9. Scales around peduncle 10. Dorsal origin over base of ird or fourth anal ray, midway between caudal base and preopercle. Dorsal base ngth four times in distance from preopercle to caudal base. Anal base only barely nger than dorsal base. Caudal rounded. Dorsal and anal pointed.

Color in alcohol pale gray without evident markings on fins or body, except r darker scale-pockets.

This is the smallest known species of *Cynolebias*, and it is unlikely that y smaller will be discovered. The striking red and green curved bars on the ver- al fins of the male distinguish this fish from all the other species. It will be

noted that, as in *opulescens*, the females tend to have higher fin-ray counts tha the males. The females are practically indistinguishable from those of *splendens* and *zingiberinus*, but there is no doubt of the distinctness of the species.

Cynolebias splendens, new species

Holotype.—Stanford 36527; an adult male, 22.5 mm standard length; fro water holes or ponds along base of Serra do Petropolis, State of Rio de Janeir Brazil; June, July, or August, 1941; Lt.-Col. and Mrs. T. D. White. See under *C zingiberinus* for description of type locality.

Paratypes.—Three adult males, same data as holotype.

Description of male.—Dorsal 14. Anal 19. Lateral scales 26. Transvers scales 10. Scales around peduncle 12. Head 4 in standard length, depth 4.5. Eye in head, equal to or slightly greater than interorbital. Snout about half eye Dorsal origin over base of third or fourth anal ray, midway between eye and base o caudal. Base length of dorsal four times in length of body behind hind border o eye. Anal base three times in same distance. Caudal rounded. Dorsal and ana pointed.

Color in alcohol dull brownish, the body banded from head to caudal bas with alternate light and dark vertical bands (13 or 14 dark bands), the dark one broader and the light interspaces only half as wide or less. These dark bands ru out on the dorsal and anal fins for a short distance and then fade out. One para type shows the bands faintly on the caudal, but the bands on that fin are curved, the convex side away from the caudal base.

A color sketch of a live male shows the dark bands intense Paris-green i color, the narrow interspaces brilliant light red. The head is largely red, wit green spots. The red cross-stripes, but not the green bars, run out on the basa parts of the dorsal and anal fins and then disappear into the solid red color o the fins. The dorsal has a green edging, as has the upper border of the solid re caudal. Pectoral and pelvic pale yellow. Iris green.

This tiny fish is nearly as small as *minimus* and Lt.-Col. White considers it to be normally quite as small. It differs from all the other species in the red and green bars on the body, and those specimens in which the bars run out on the caudal have them curved in the opposite way from those of *minimus*. This is the most gaudy of all the Rio species.

The difficulty in separating the females of this species from those of *zingiberinus* has been mentioned, and if *minimus* were found in the same locality, its females also would likely be indistinguishable. Lt.-Col. White could not separate females of *zingiberinus* from those of *splendens* after prolonged study of living specimens in aquaria.

Austrofundulus transilis Myers

This Cyprinodont was described from a single specimen in the U.S. National Museum, sent by the Rockefeller Foundation for identification as a mosquito-destroying species. The locality data were not very specific, but the fish was supposed to have been taken in the Orinoco drainage of Guarico, Venezuela. Dr. Bond has rediscovered this fish in some abundance in the Maracaibo basin. He obtained 27 small specimens in pools 20 km. south of Lagunillas, Venezuela, on the east side of Lake Maracaibo on March 23, 1938 (Coll. no. 91); and six adult and half-

rown specimens in a reservoir 15 km. west of San Felix, Venezuela (Estado Falcón,) km. northeast of Altagracia) (Coll. no. 86), on March 21, 1938. The specimens igured are from the latter station, the male being 63 mm and the female 60 mm tandard length. The largest male is even larger, 87 mm standard length, and is ore robust, with a deeper peduncle, than the figured male. The species is without oubt prettily colored in life, but the alcohol specimens are dull tan with black-sh spots and dark fins. In form and size this is one of the most striking of the outh American Cyprinodonts. From its occurrence in pools and reservoirs one might uspect that it is an annual species, like *Cynolebias*. Like that genus, the anal ays of the female *Austrofundulus* are higher and stiffer than those of the male; he fin is seldom folded in females.

Rivulus zygonectes Myers

Lt.-Col. White obtained several examples of this little-known species at arolinha, lower Rio Tocantins, on October 5, 1941. His color sketch shows the body iolet with numerous small red spots and a black band from snout through eye and nding as a black edging to a yellow spot at the root of the caudal. The vertical ins are yellow with a black edging, the caudal and dorsal with rows of dark dots orming cross-bands. Belly and under side of head white. Paired fins pale yellow.

Pterolebias longipinnis Garman

This genus and species, long known only from the types collected by Louis gassiz at Santarém, Lower Amazon, has recently appeared in very small numbers in he Amazonian importations of New York aquarium dealers. Fowler has reported one ale specimen from this stock that is now in the Philadelphia Academy, and Mr. illiam T. Innes has recently sent me a similar adult male for the Stanford col-ection. Through the courtesy of Mr. Fowler and of Mr. J. Louis Troemner, editor of The Fish Culturist," I am enabled to reproduce Mr. Fowler's drawing of his example or comparison with the other genera and species I am now figuring.

Rivulichthys rondoni (Miranda Ribeiro)

This species has been known only from the types, from the upper Paraguay, in he Museu Nacional in Rio, but these have been lost according to information re-eived from Dr. Paulo de Miranda Ribeiro. Several years ago my friend Mr. F. H. toye, of Sayville, New York, obtained a live pair of a strange Cyprinodont from a ew York importer of aquarium fishes. He kept them for some time in his aquarium nd I had a brief opportunity to see them alive. The male was a rather bright yel-ow-brown, each scale of the mid-sides, from head to tail, with a dull red spot, hese forming longitudinal rows along the scale-series. The female was smaller and acked the bright colors of the male. Later the male jumped out of the aquarium and as killed and partially dried, and the female died of natural causes. These two pecimens were preserved by Mr. Stoye and given to me; they are now in the Stanford ollection. They are both in very poor condition but they seem without doubt to be his species. The information given Mr. Stoye by the dealer—that the fish came rom far up one of the Amazonian tributaries in Matto Grosso—was doubtless entire-y correct, for I would fully expect to find the Cyprinodonts of the upper Paraguay ributaries of Matto Grosso in the near-by Amazonian tributaries as well.

Fig. 13. *Austrofundulus transilis.* Male. Reservoir 15 km. west of San Felix, Venezuela. Drawn by Pascual Ortiz.

Fig. 14. *Austrofundulus transilis.* Female. Reservoir 15 km. west of San Felix, Venezuela. Drawn by Pascual Ortiz.

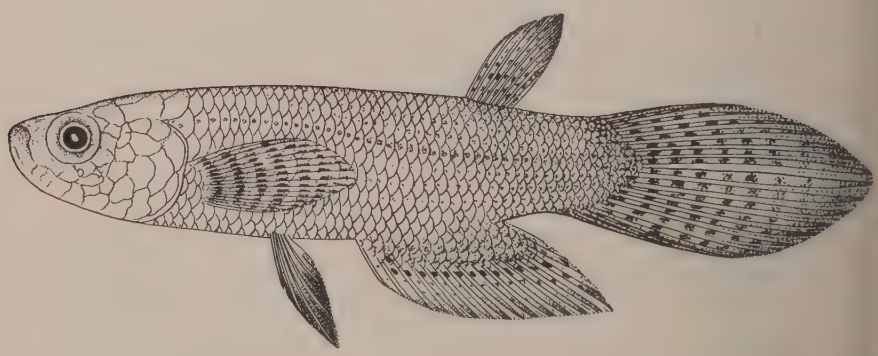


Fig. 15. *Pterolebias longipinnis.* Male. Aquarium specimen from the Amazon. Drawn by Henry W. Fowler and reproduced through courtesy of "The Fish Culturist."

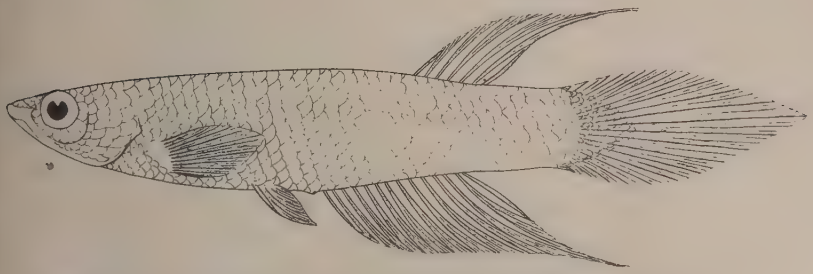


Fig. 16. *Rivulichthys rondoni*. Male. Drawn by Pascual Ortiz.

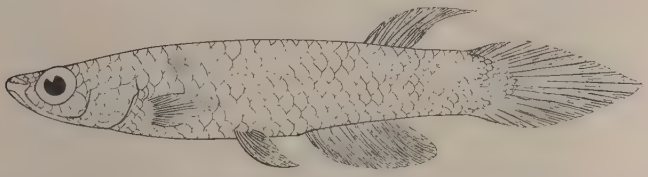
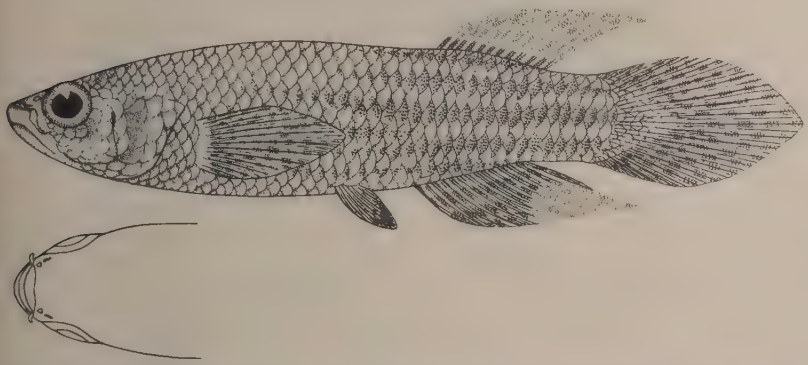


Fig. 17. *Rivulichthys rondoni*. Female. Drawn by Pascual Ortiz.



g. 18. *Neofundulus paraguayensis*. Holotype. Arroyo Trementina, Paraguay. Drawn by Pascual Ortiz.

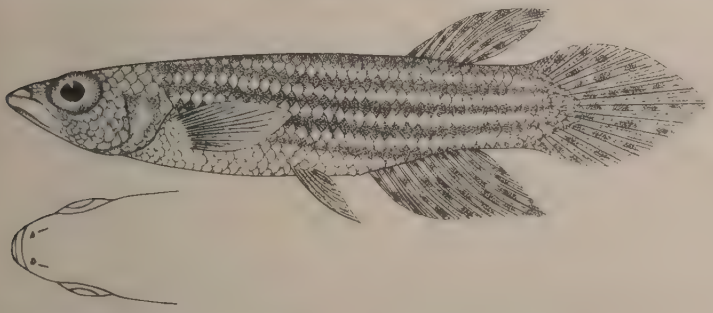


Fig. 19. *Trigonectes strigabundus*. Adult cotype (syntype). Porto Nacional, Rio Tocantins, Goyaz, Brazil. Drawn by Pascual Ortiz.

Due to the very poor condition of the specimens the accompanying figures the male and female are not to be trusted in the fin- and scale-counts, but th give a very good idea of the general form of the fish. In life, the apparent acuminate caudal is more widely spread and appears much rounder and less pointed a circumstance that should always be remembered in interpreting drawings made fr preserved Cyprinodonts. In life, the attenuated dorsal and anal rays of the ma were even longer than shown in the drawing.

Neofundulus paraguayensis (Eigenmann and Kennedy)

This species has hitherto been known only from a single specimen, from A royo Trementina, Paraguay. The holotype, now belonging to the California Acade of Sciences, is figured herewith. The broken dorsal and anal are completed in ligh stippling. Lt.-Col. T. D. White of the U.S. Army Air Force has recently sent t two specimens now in the Stanford Museum. He collected these on November 28, 194 in an unused clay pit in a brickyard on the east bank of the Rio Cuyabá, at Par six km. from the town of Cuyabá, Matto Grosso, Brazil. The clay pit was overgrow with brush and trees; it contained a heavy growth of water hyacinths. There ver some underwater plants; average depth at banks two feet. A water color sketc taken from one of the specimens alive in an aquarium shows the ground color pal brownish or yellowish, with a greenish suffusion on the upper part of opercle an back along middle of sides. The longitudinal rows of spots on the scales are brow as are the rows of spots in the anal, dorsal, and basal part of caudal. A bar o three stripes, the outer pale pinkish, the middle white, the inner brown, across and along under part of caudal. Iris yellow. Vertical fins brownish towards edges. Pelvics and pectorals unmarked, the former elongated and sharply pointed. Lt.-Col. White kept his specimens alive for a time in his aquaria in Rio.

Trigonectes strigabundus Myers

This distinctive genus and species has never been figured. I present here with an excellent illustration of one of the syntypes, collected by the late Dr. Carl Ternetz at Porto Nacional, Rio Tocantins, Goyaz, Brazil.

Family CICHLIDAE

Cichlasoma kraussi (Steindachner)

This is one of the most characteristic Cichlids of the Maracaibo basin. Several specimens, the largest of approximately 175 mm, from Quebrada Sargento, tributary of the Rio Limón, north of Maracaibo, Venezuela; Dr. F. F. Bond (Coll. no. 98). This species has been known only from the Magdalena and Atrato basins in Colombia.

Aequidens latifrons (Steindachner)

Four examples, the largest of 95 mm, from Quebrado Sargento, north of Maracaibo, Venezuela; Dr. F. F. Bond (Coll. no. 98).

REDISCOVERY OF THE BUNOCEPHALID CATFISH *XYLIPHIUS* IN THE RIO MAGDALENA, COLOMBIA

By Cecil Miles

Prior to Dr. Eigenmann's visit to Colombia in 1912, no Bunocephalid fishes been recorded from that area, and it was assumed that the Andes formed a west- barrier to the family. During his expedition of that year, however, he dis- ered two species, both of which were new, namely, *Bunocephalus colombianus* and *iphius magdalenae*. The first species was found in some quantities in the Atrato, in the following year also in the Patía by Henn and Wilson. It has the tradi- nal characteristics of the family, and the various specimens are preserved in Carnegie Museum at Pittsburgh and the old Indiana collection in the California demy of Sciences at San Francisco.

The second species, however, differed radically from the previously known bers of the family, and has until now been known only from the type, a small cimen measuring 32 mm. It is thought, therefore, that Eigenmann's rather brief cription of this somewhat rare fish may be profitably enlarged upon. There are or variations between the two specimens, principally in the coloring, the number hooks on the pectoral spine, and the presence of ridges on the head.

Xyliphius magdalenae Eigenmann

iphius magdalenae Eigenmann, 1912 (1913), Indiana Univ. Studies, no. 16, p. 10 Girardot); 1922, Mem. Carnegie Mus., vol. 9, p. 27, pl. 1 (on the type).

Stanford 37075; one, 60 mm standard length; Rio Magdalena at Honda, Colom- .; December 1, 1941; Luis Olaya, collector. The measurements of the type, where wn, follow in parentheses those of the described specimen.

D. 5 (5). A. 7 (7). P. I,5 (I,5). Depth 7 (7). Depth of caudal peduncle 13 .), equals space between anterior nares. Depth and width about equal at level of .t, about half the width at pectoral origin. Head to middle of gill-opening a tle over 4 (5), about as wide as long. Gill-membranes attached to isthmus, not lependently movable, the gill-opening short, remote, entirely inferior, and al- st imperceptible. (Note: what appears to be a gill-opening immediately in front the humeral process is merely a fold.) Eyes minute, their distance from the sterior nares about half the internarial space; the nares and eyes in a straight ne. The anterior nares fail to reach margin by half internarial space, and con- st of small antrorse tubes. Snout equals interocular distance, about 2.5 in head. th subterminal, wide, about 1.5 in head, the lower lip attached to the maxillary bels at the rictus by a membrane. A fringe of 22 (about 20) white tapering pa- lae screening the mouth opening, their length about equal to the thickness of maxillary barbels at their origin. Maxillary barbels reach to or just beyond ot quite reaching) origin of pectorals. Mental barbels in two pairs, the outer r the longer and notably the farther back.

The pectoral spine is produced in a short, curved filament. Length of spine hout filament greater than depth of body, with filament it equals distance from cillary barbel, or width of body immediately behind the spine, and reaches to gin (middle) of ventrals. The spine is short and strong, with six (four) needle- rp hooks on the posterior margin, the outer margin smooth.

Ventrals just short of (just reaching) anal; the vent equidistant between of snout and base of caudal fin. Distance from snout to dorsal, snout to ven-

[1]Of Mariquita, Colombia.

Fig. 1. *Xyliphius magdalenae* Eigenmann. (a) Pectoral spine of original type (not to the same scale).

.s, and origin of anal to origin of caudal, all about equal, 2.4 (2.33) in the ıdard length, or failing to equal remaining portion of body by the length of the .oral spine. Caudal obliquely truncate. Length of coracoid process two (2) in ' intercoracoid space.

Head wide, depressed; predorsal profile almost straight; caudal peduncle cylindrical to compressed. Four notable ridges on head, two originating at tip snout, diverging to a point immediately behind the eyes, thence converging to ı the occipital crest, leaving a flat, diamond-shaped plateau from snout to st; and two outer ones, which are continued along the body.

Color in alcohol, after formol fixing, bluish on head, with light patches ind the eyes and black patches in neighborhood of anterior nares; yellowish on y, with about six brown longitudinal stripes arising in region of dorsal and ging together on caudal peduncle, which is dark brown. Caudal fin black with ısparent or white edges. Pectoral spine and rays dark brown. Center of dorsal x. Fin is damaged in my specimen. Other fins transparent. Body covered with ıte warts, including maxillary barbels and pectoral spines, less obviously so belly, which is white and slightly granular. Two rows of larger, evenly spaced ts along the back on either side of the dorsal.

GLYPTOTHORAX HOUSEI, A NEW SISORID CATFISH FROM SOUTH INDIA

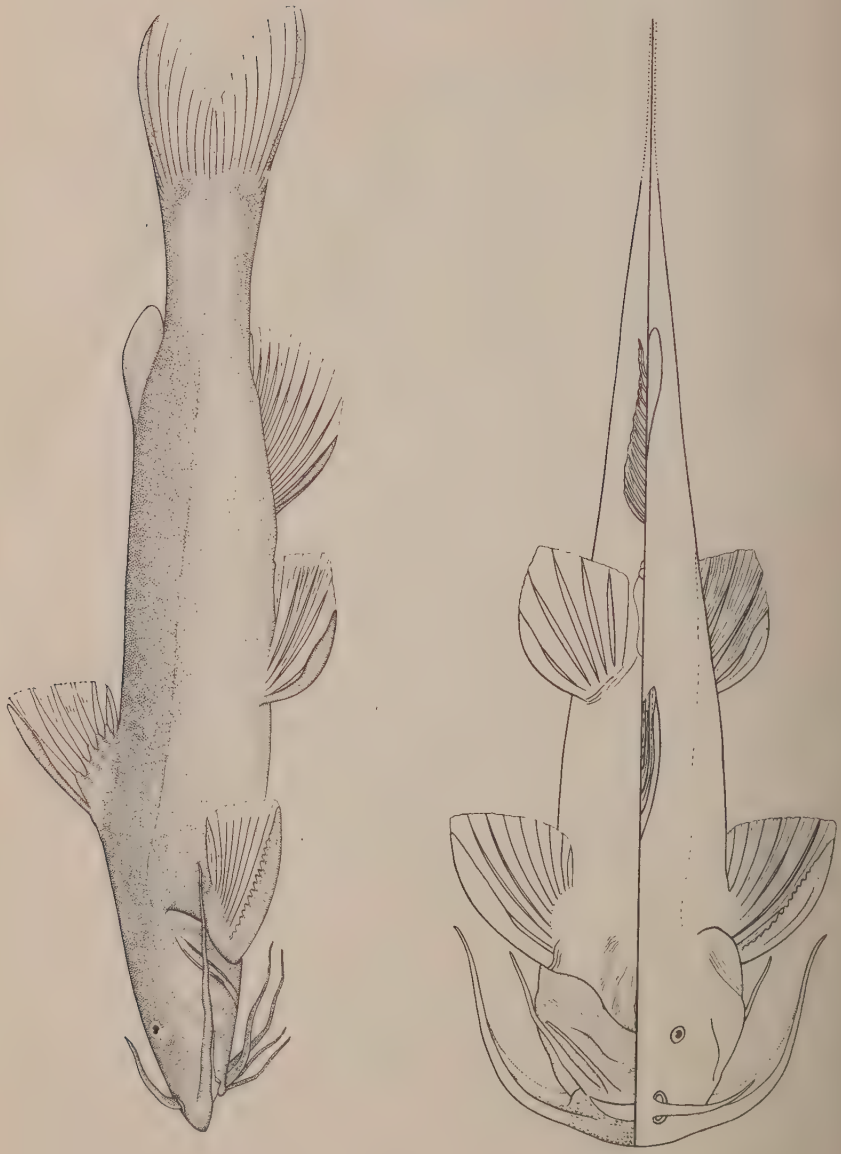
By Albert W. Herre

Glyptothorax housei, new species

Dorsal I,5; anal II,10; pectoral I,9. Depth 6.2 to 6.4, head 3.9 to 4.1, dal 3.8 to 4 times in standard length. Least depth of caudal peduncle approxi- ely 1.5 times in its length. Body and head covered with thick, smooth skin. adth of head approximately 80% of its length; snout moderately depressed, the erior dorsal profile rising to dorsal origin, then descending slightly and near- horizontally to the adipose dorsal. Under side flattened back to the pectoral dle; ventral profile slightly arched. Caudal peduncle laterally compressed.

Eyes 12.5 to 13.6 times in head length, 5.75 to 6.3 in snout, 3.75 to 4.2 es in the arched interorbital; and are at the middle of the head. Snout and storbital part of head equal or nearly so, 2.15 to 2.17 times in head. Maxillary bels reach to pectoral axil or beyond, their basal half with a wide flat skinny ıp, striated beneath so as to help as an accessory adhesive apparatus. Nasal bel extends to middle of, or beyond, the eye. Outer mandibular barbel extends to se of pectoral spine or to base of first or second ray; inner barbel much short- , reaching only to gill-opening or a little beyond. Mouth ventral, its gape equal half width of head, arched above, but lower jaw nearly straight. Lips, covered th coarse granulate papillae, are continuous around the angles of mouth, the ıial groove very widely interrupted. Underside of head with granulate papillae ranged in radiating lines, forming an accessory adhesive apparatus. Thoracic nesive apparatus well developed, large and broad, with ridges developed over its ole surface except the posterior end of the midventral line, usually more so an shown in the figure (of a paratype). Underside of pectoral spine plaited to lp in adhesion. Occipital process does not reach basal bone of dorsal spine, and six times as long as broad; it can only be seen by removing the skin, beneath ich is a thick yellow layer of fat.

Dorsal origin over posterior part of pectoral, about midway between tip of



; and anal origin, its smooth spine covered with thick skin; its height is less depth of body below it; in specimens less than 75 mm in length it may equal body depth, 1.5 to 1.7 in head. Base of adipose fin contained 2 to 2.4 times istance between dorsals. Pectoral fin shorter than head; its broad, stout spine red with thick skin, its inner margin strongly serrate. By removing the skin ring the spine, one can find, in the largest specimens, a few minute teeth on outer margin; all others having it smooth. The ventrals are much shorter, exing to or beyond the anus, but well separated from the anal fin; the two outer are more or less plaited beneath, to serve as accessory adhesive organs. Anal lies beneath or partly in advance of adipose dorsal; its height a little more twice in head. Caudal fin deeply forked, its lower lobe the larger.

In life the color is reddish, pinkish, or flesh-color with yellow and dusky ling above, and flesh-color below. In preservative the general color is dull y or blackish, except on belly and underside of head; fin-rays black or black- the membranes usually clear; adipose fin black, with a pale margin.

Described from the holotype (Stanford 36531), 103 mm standard length, and 50 types (Stanford 36532), 40 to 103 mm standard length; from rapids in a mountain am in the Anamallai Hills, Puthutotam Estate, four miles east of Valparai, achi District, South India; altitude approximately 3600 feet; January 10, 1941; ected by the author.

Five species of *Glyptothorax* have previously been known from South India, of h but one, *G. conirostre poonaensis* Hora, has smooth skin. *Glyptothorax housei* eparated from the above species by the longer barbels, especially the maxillary nasal ones; the size and lesser height of the dorsal and its greater distance the adipose fin; the size and position of the anal; the shorter head; and the ter development of adhesive organs. The remaining species, *G. madraspatensis*), *G. lonah* (Sykes), *G. annandalei* Hora, and *G. trewavasae* Hora, all have tuulated skin, which differentiates them from *G. housei* at once.

I take pleasure in naming this species for Mr. E. N. House, manager of the utotam Estate, to whose hospitality and generous assistance the success of my f visit to the Anamallai Hills is due.

BUNAKA STICTA, A NEW PHILIPPINE ELEOTRID FISH

By Albert W. Herre

Bunaka sticta, new species

Dorsal VI-I,8; anal I,8; pectoral 20; scales in longitudinal series 52, in sverse series, 20 or 21; predorsal scales 46, and six rows on the interorbital h. Depth of the very robust and thickset body 3.8 times, head 2.87, caudal 3.6, oral 4.2, and ventral 4.88 times in standard length. Head depressed anteriorly, full cheeks and projecting lower jaw; its breadth almost equal to body depth. small, 7.3 times in head, twice in interorbital, and 1.5 times in the wide, t, gently rounded snout. Interorbital 3.65, snout 4.86 times in head length. h wide, maxillary extending beneath hind edge of eye. Teeth all very small, of t rows in each jaw, forming wide bands; in the lower jaw the band is reduced to t five or six rows posteriorly.

Vertical fins of moderate height; third spine of first dorsal twice in body h, longest ray of second dorsal 1.6 times, of anal 1.7 times. Pectoral and ial both broadly rounded, with somewhat pointed tips, ventrals narrow and point-

ed. Caudal peduncle broad, its depth equal to its length. Anal papilla large, fl and nearly circular, its tip bifid.

Anterior half of interorbital space, snout, lips, and underside of h naked; all the rest is covered with scales, which extend upon the basal fourth the caudal and pectoral fins. Scales on sides from head to tail ctenoid, the oth cycloid. From below eye, two series of mucous papillae, each dividing into two three rows, extend longitudinally across cheek; no vertical cross-lines of papil could be discovered.

Color in alcohol dark reddish brown, with a blackish spot on each scale the upper part, these spots forming more or less evident longitudinal rows; unde side reddish; head, sides, and underparts spotted with large, more or less i regular, pale blotches and circular spots, which are either yellow or red in lif The spotted coloration is suggestive of *Oxyeleotris marmorata* Bleeker. First do sal with wide blackish band on its upper half, the tips of the third, fourth, a fifth spines clear; the second dorsal blackish brown, with three pale longitudin stripes (red or yellow in life) on its upper half; anal and ventrals barred by s or eight alternate bars of dark brown and pale reddish; caudal similarly cros banded.

Here described from the holotype (Stanford 36534), a very obese female nea ly ready to spawn, with a standard length of 210 mm; from the Tagaloan River, Tagaloan, Oriental Misamis Province, Mindanao, Philippine Islands; August 21, 194 collected by the author.

From *Bunaka pinguis* (or *gyrinoides*, according to Koumans), *B. sticta* distinguished at sight by its greatly different coloration, the first named bei uniform brown to blackish above and on sides, and pale beneath, with darker long tudinal lines, one for each row of scales.

Sticta, from the Greek *stiktos*, spotted.

A NEW GENUS AND SPECIES OF GOBIESOCIDAE FROM THE PHILIPPINES

By Albert W. Herre

As has been stated repeatedly, no region in the world surpasses the Philip pine Islands in the richness and variety of the fish fauna. With every collection additions are made; fishes hitherto known only from other regions are found t occur also in Philippine waters; while others entirely new to science are discov ered. There are still great areas in the Philippines that are little or not at al explored, as far as their fish life is concerned, so that fresh discoveries may b expected for a long time to come.

From the latter part of May until October, 1940, I was engaged in field work in various parts of the Philippines, securing many novelties and rarities. The mos remarkable fish secured, the subject of this paper, was collected at Busuanga, the northernmost island of that portion of the Philippines which once formed a part o Borneo.

CORONICHTHYS, new genus

This genus is separated from other genera of the Gobiesocidae by its long, narrow, much flattened, spatulate snout, and by its comparatively large and bilobed teeth, which are in a single row in each jaw. The small mouth is on the underside

Fig. 1. Type of *Coronichthys ornata*. Drawn by Pascual Ortiz.

of the snout, which extends beyond it. The low dorsal and anal are moderately lo very far back, and opposite each other. The gill-openings are narrow; the gill-m branes attached to the broad isthmus. The anterior margin of the posterior divisi of the adhesive disk is not free. No nostrils could be detected. Branchiostegals

Genotype *Coronichthys ornata*. The name is derived from Coron, the small t where the species was collected.

Coronichthys ornata, new species

Dorsal 12; anal 14; pectoral 18; caudal 18; ventral I,4.

Depth of body 10, its breadth 8.6, head length 2.4, caudal 9, pectoral 11. times in standard length. The elongate, spatulate, and much flattened snout 1.8 head; viewed dorsally it tapers until just before the mouth, where it is expand for the jaws, and terminates in a little nipple-like tip. Basal width of snou little more than 3.25 times in its own length, and its width above mouth nearly Eye 6.8 in head; the flat interorbital twice in eye. The small inferior mouth near tip of snout, its length 1.5 times its breadth, which is about half eye d ameter. The bilobed teeth are comparatively large, in a single row, closely spac anteriorly, more widely separated posteriorly. Dorsal and anal both low, slight attached to caudal base, their bases of equal length and about 2.1 times in hea Caudal and pectoral both small. Distance from vent to anal origin 1.76 times distance from disk to anus.

Color in life cardinal, with a white longitudinal stripe along middle dorsum, venter, and each side. The dorsal and ventral lines extend from snout-t to the caudal, the lateral stripes from snout-tip to a short distance before t caudal, the posterior part a little above the midline. On the caudal fin a yell spot, with a blackish red bar, almost V-shaped, its tip extending backward; caud tip colorless.

In alcohol the specimen is much paler, the white stripe above and unde neath partly gone, and the caudal bar changed to scarlet.

Here described from the holotype and sole specimen (Stanford 36533); 36 standard length; taken from the crevices of the little dock of coral heads at Co on, Busuanga, Philippine Islands; June 29, 1940; collected by the author.

A NEW GOBY, *SICYDIUM FAYAE*, FROM THE TRES MARIAS ISLANDS, WEST COAST OF MEXICO

By Vernon E. Brock

Sicydium fayae, new species

Holotype.—Stanford 36535; a male, 76.5 mm standard length; from spring-fe pool, north side of Cleopha Island, Tres Marias group, Lat. 21°17'24"N, Long. 10 17'54"W[2]; February 19, 1940; collected by the author.

Paratype.—Stanford 36536; a female, 73.3 mm standard length; obtained wit the holotype.

Description.—Dorsal VI,11; anal 11, pectoral 20 (21). Scales fine and ir regular, 106 (average of four counts) in longitudinal series from above opercula

[1]Of the Fish Commission of Oregon.

[2]Las Tres Marias are reported to be three miles further east than shown on t chart from which this position was ascertained.

gin to caudal base, in male; 89 (average of four counts) in female. Body com-tely scaled except for area immediately below pectoral and ventral fin bases, l forward of ventral fin. Scales extend forward to occipital region; none on id. Scales largely ctenoid except on ventral surface.

Body cylindrical and moderately elongate. Measurements, in hundredths of ndard length: depth 16.5 (17.5 in female); head 23.6 (23.2 in female); eye 4.1 both sexes); snout 9.7 (9.4 in female); maxillary 11.8 (11.0 in female); inter-ital space 8.8 (9.4 in female). A broad groove, into which first dorsal is set, ends along midline of back to occipital region, deepest between dorsal and oc-ital. Spines of first dorsal in male elongate, third and fourth the longest, and ut equal, 33 hundredths of standard length; second spine 26.3; first spine 14.6. gest dorsal spine, laid back, will reach to seventh dorsal ray. In female the rth spine of first dorsal 10.9; third 16.2; second 14.3; first 12.3. Last ray of ond dorsal in male extends past caudal base; in female the tips of second dorsal l anal are opposite, neither reaching caudal base. Pectoral fin of male, 21.7, is newhat arrow-shaped; greatest width 1.66 times in length of fin. In female, 20.1 length, more rounded, width 1.44 in length of fin. Caudal peduncle compressed.

A pore on side of head is slightly posterior to posterior margin of eye, and line with ventral margin. Eye high on head; interorbital wide and flat. Snout, m above, flat and somewhat triangular; in profile, a gentle, flattened curve m eyes to sharply curved snout-tip above mouth. Mouth inferior, with fleshy s; vertical line from end of maxillary passing through anterior margin of pupil eye. Maxillary teeth in single row, interrupted at middle, beneath median notch upper lip; bicuspid, the exposed portion straight, and corn-yellow in color, ost at right angles to the much larger root. Upper oral valve margin in Cupid's curve with very small, sharp V-shaped notch at center, the tips of the V thick-ed. Horizontal teeth of lower jaw concealed; a single row of large, curved ca-nes behind, five or six on a side, 11 altogether.

There is a broad, brownish lateral band, broken into several double cross-rs on caudal peduncle in male, continuous in female. Back covered by coarse, ir-gular, brownish markings, giving a marbled effect, these markings with tendency form cross-bars on caudal peduncle. Pattern of back and lateral band separated light background-colored stripe, which is crossed occasionally by the darker rkings. Scattered scales, most abundant on caudal peduncle, with dark centers. ntral surface unmarked. Head and opercles slate-colored; a few small black spots d irregular black lines in occipital region; a shallow, V-shaped slate-colored r between eyes, margined in black. Irregular line down from eye, paralleled by milar line on cheek; these much darker and sharper in female. A few dark spots pectoral fin base; pectoral fin immaculate. First and second dorsal fins with ws of small black bars on membrane, set at an angle to fin-rays and spines; coars-in female, and occurring on fin-rays. Second dorsal with faint dark marginal nd, more pronounced in female. Anal with faint immaculate margin followed by rk band, likewise more pronounced in female. Upper edge of caudal with thin dark ging in male; in female the outer, upper edge of caudal clear, followed by wider rk band.

Fayae for Faye, my wife's middle name.

Sicydium fayae differs from other American species of this genus in color ttern and in the number of scales in a longitudinal series, the present species ing a fine-scaled form, with considerable sexual dimorphism. It is the most nor-ern representative of the genus on the Pacific Coast of North America; *Sicydium mnogaster* Ogilvie-Grant, which was reported as being taken at Mazatlan in the iginal description, was actually taken at Misantla, according to Regan (Biol.

Fig. 1. *Sicydium fayae*. Side view of male holotype.

Fig. 2. Top view of holotype.

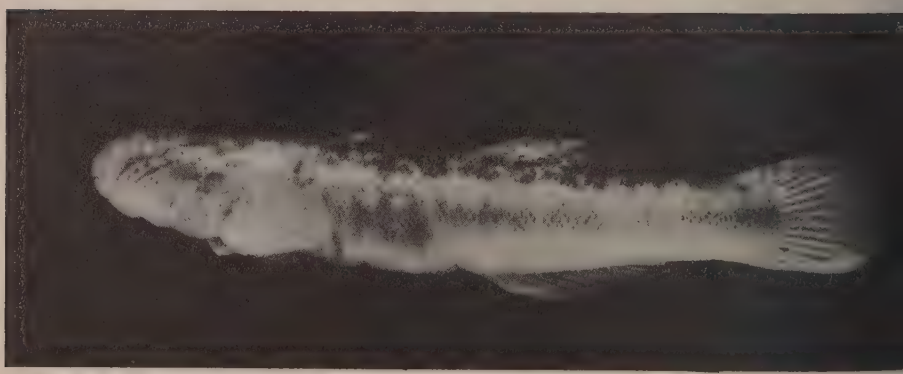


Fig. 3. Side view of female paratype.

Centr.-Amer., Pisces, Oct., 1906, footnote and text on p. 11), which is on the Gulf of Mexico, north of Vera Cruz.

In general it may be said that the species of this genus, at least the American ones, need to be more fully defined. The degree of variability of various diagnostic characters used by authors is a matter of uncertainty. Superficially, at least, the species are much alike.

I wish to thank Dr. George S. Myers for a number of very helpful criticisms, and for a place to work at the Stanford Natural History Museum while writing this and other papers.

THREE NEW PIPEFISHES FROM THE ATLANTIC COAST OF NORTH AND SOUTH AMERICA, WITH A KEY TO THE ATLANTIC AMERICAN SPECIES

By Earl Stannard Herald

Present conditions having necessitated a termination for an indefinite period of the author's studies of Atlantic pipefishes, it seems advisable, under the circumstances, to publish this preliminary paper, describing three new forms, and presenting a key to the Western Atlantic species.

Syngnathus springeri, new species

Syngnathus louisianae (in part) Fowler, 1921, Proc. Acad. Nat. Sci. Phila., p. 444; Longley and Hildebrand, 1941, Carnegie Inst. Washington publ. 535, p. 64.

Holotype.—Stanford 36460, a female, 125.5 mm standard length, collected at Lemon Bay, Englewood, Florida, about 1937, by Stewart Springer.

Paratypes.—USNM 25628, a juvenile, 89 mm standard length, collected at Charleston, South Carolina, June 9, 1880, by C. C. Leslie; USNM 100453, a juvenile, 74 mm standard length, taken at Station 10 (=7796), Boca Grande Light, Florida, January 2, 1913, by the Fish Hawk; Acad. Nat. Sci. Phila. 15753, a female, 265 mm standard length, collected at Pensacola, Florida, by Dr. F. B. Stevenson.

Diagnosis.—Dorsal fin rays 33-36; pectoral 12-13, rarely 14; anal 3; caudal 10; trunk rings 23; tail rings 36-37; dorsal fin covering 3-4 trunk rings and $3\frac{3}{4}$-$4\frac{2}{3}$ tail rings; head-in-standard length 7.75-8.75; dorsal-in-head 1.01-1.32; snout-in-head 1.96-2.13; brood pouch on first 17 tail rings.

Discussion.—In all characters, with the exception of the number of trunk rings, length of snout, and number of pectoral fin rays, *Syngnathus springeri* is identical with *S. louisianae*. As in the latter species, there is a slight ventral deflection of the median lateral trunk ridges at the anal break. Only one (15753) of the four type specimens showed the overlapping of the median ridges in the region of the anus, which is often, but not always, present in *S. louisianae*.

One additional specimen is referred to this species. It is one of four determined as *S. louisianae* and recorded in the Systematic Catalogue of the Fishes of Tortugas, Florida, by Longley and Hildebrand (1941). Dr. L. P. Schultz has kindly rechecked the ring counts, and finds them to be 23+35, with the brood pouch covering the first 17 caudal rings. The Catalogue also lists the dorsal as 34 and covering $3\frac{1}{2}$+4 rings. Due to lack of time, it was not possible to have the specimen forwarded to the author for examination.

The two USNM paratypes are a uniform light brown, and quite probably were differently colored in life. The holotype is also brown, but in addition, each

ring has two or three dark brown spots between it and the following ring. Thes spots are on the superior, median, and ventral ridges, respectively, so that ther are three spots between each ring on the trunk, and two between each ring on tr tail. The caudal fin is anteriorly light brown, but posteriorly is a conspicuou blackish brown. This dark area in the caudal fin is not complete, for a colorles area is present postero-dorsally and postero-ventrally in the fin. The Phila. Acad paratype is bleached, and has a very light brown appearance.

Comparisons.—From *S. louisianae, S. springeri* may be differentiated by th following characters:

	Trunk Rings	Snout-in-Head	Pectoral Fin Ray
S. louisianae	(19) 20 (21)	1.58-1.88	(13) 14-15 (16)
S. springeri	23	1.96-2.13	12-13 (14)

Syngnathus louisianae usually has 20 trunk rings, although 19 and 21 are no uncommon. (Of the 75 specimens from various localities which were counted, 11, o 14.7%, had 19 rings; 59, or 78.6%, had 20 rings; and 5, or 6.7%, had 21 rings. Pectoral fin rays are usually 14 or 15; counts of 13 and 16 rarely occur.

The only other Atlantic American pipefish which has more than 21 trunk ring is *Entelurus aequoreus*, but that species may be readily differentiated from *S. springeri* by its lack of pectoral fins.

Syngnathus louisianae and *S. springeri* will be discussed in detail in forthcoming paper on the pipefishes of the Atlantic American coasts. Table 1 pre- sents measurements and counts for the types of *S. springeri*. This species is name in honor of Mr. Stewart Springer, of Englewood, Florida.

Syngnathus folletti, new species

Holotype.—USNM 39144, a female, 177.5 mm standard length, collected at Flores Island, Montevideo, Uruguay, by Arechaveleta.

Paratypes.—USNM 119829, a female, 120 mm standard length, same data as holotype; USNM 86172, a female, 143 mm standard length, collected at Cabo Sant Maria Rocha, Uruguay, by Dr. F. Felippone.

Diagnosis.—Dorsal fin rays 38-40; pectoral 14-15; anal 3; caudal 10; trunk rings 16-18; tail rings 37-38; dorsal fin covering $1\frac{1}{2}$-$2\frac{1}{3}$ trunk rings and $6\frac{1}{2}$-7 tail rings; head-in-standard length 8.17-9.85; dorsal-in-head .81-.98; snout-in- head 1.99-2.10; pectoral base-in-pectoral length 1.77-1.84.

Description.—All ridges on the head, trunk, and tail are accentuated. In types 39144 and 119829 the ridges are markedly serrated, whereas in type 86172 the serration is absent or only slightly evident. Median snout ridge present, ending just posterior to the nostril. A tri-lobed ridge on top of head. Supra-orbital ridge extending anteriorly to nostril and posteriorly for about $\frac{3}{4}$ diameter of or- bit. An infra-orbital ridge (the posterior portion of which is present in no other American Atlantic pipefish) extends anteriorly to nostril and ventro-posteriorly to base of opercle. Opercular ridge sharply distinct; it extends posteriorly for one-third the opercle length. Pectoral fin cover plate with both the superior (oblique) and the inferior ridges present.

When compared with the widest trunk rings, the dorsal fin is equal to the width of approximately 2 rings; the pectoral $1\frac{1}{2}$; the anal slightly less than 1; and the caudal approximately $2\frac{1}{2}$.

Table 1. Data from the types of *Syngnathus springeri* and *S. folletti*.

	S. springeri				*S. folletti*		
	Stanford 36460 female	USNM 100453 juv.	USNM 25628 juv.	Phila.Acad. 15753 female	USNM 39144 female	USNM 119829 female	USNM 86172 female
easurements, in mm:[1]							
Standard Length	125.5	74.0	89.0	265.0	177:5	120.0	143.0
lead	15.7	9.5	11.5	30.3	18.0	14.5	17.5
Snout	8.0	4.8	5.4	15.4	8.8	7.3	8.7
Trunk	42.0	25.5	30.0	96.0	48.8	32.9	36.4
Tail	67.5	39.0	47.0	139.0	111.0	72.3	89.5
Dorsal Fin Base	13.2	7.2	8.8	29.9	22.8	14.8	18.5
ounts:							
Rings	23+37	23+36	23+37	23+36	17+37	18+38	16+37
" Covered by Dorsal	$3\frac{1}{4}+4\frac{2}{3}$	$3+4\frac{1}{2}$	$3\frac{1}{3}+4\frac{1}{2}$	$4+3\frac{3}{4}$	$2\frac{1}{3}+6\frac{1}{2}$	$2+6\frac{3}{4}$	$1\frac{1}{2}+7\frac{1}{2}$
Dorsal Fin Rays	33	33	35	36	39	38	40
Pectoral Fin Rays	13-12	12-12	13-13	14-13	14-14	15-15	15-15
roportions:							
Head-in-Std.Length	8.0	7.8	7.75	8.75	9.85	8.27	8.17
Snout-in-Head	1.96	1.98	2.13	1.97	2.04	1.99	2.10
Dorsal Fin-in-Head	1.19	1.32	1.31	1.01	.81	.98	.95
Pect.Base-in-Pect.L.	2.0	--	--	--	1.77	1.84	1.80

[1]Although measurements were made as accurately as possible, the sum of head, trunk, and tail does not always equal exactly the standard length. One mm. was considered the maximum allowable variation between the standard length and the sum of the component measurements.

Syngnathus folletti, as shown by the types, is typically a flat-bellied pecies (for the full significance of this statement, see subsequent discussion of he Atlantic species of *Syngnathus*). As the finger is passed over the trunk and ail ridges, the outstanding character becomes acutely apparent. Microscopic examination reveals the cause of the cutting sensation—minute jagged teeth on the idges of each ring. These serrations, very small at the anterior edge of the ring, radually become longer posteriorly, until the center of the ring is reached; at his point the serrations abruptly terminate, and the remaining portion of the idge on that ring is without teeth. One of the paratypes, 86172, does not show the longated teeth at the center of each ring, and instead has only a sharpened hump. Though elongated serration of the body ridges is often found in juveniles of the ynghathinae (as, for example, *S. louisianae*), it is usually lost in adults. To the uthor's knowledge, this is the only Atlantic *Syngnathus* to show this character in he adult. All three types show a ventral swelling of the trunk between the fifth nd tenth rings. A very similar swelling is often found in adult females of Lower alifornia specimens of *S. c. californiensis*. The coloration of the specimens described is not significant, as they have been bleached, and are a uniform brownish hite.

The measurements and counts for the types are given in Table 1. This species s named in honor of Mr. W. I. Follett, of Oakland, California.

Syngnathus mackayi nesiotes, new subspecies

Syngnathus mackayi Bean, 1906, Field Columbian Mus., Zool. Ser., vol. 7, no. p. 38 (11 of 17 specimens only); Beebe and Tee-Van, 1933, Shore Fishes of Be muda, p. 83; Barbour, 1905, Bull. Mus. Comp. Zool., vol. 46, no. 7, p. 115.

Holotype.—N.Y.Zool.Soc. 8919, a female, 147.5 mm standard length, taken Nonsuch, Bermuda, June 21, 1929.

Paratypes.—N.Y.Zool.Soc. 8912, 9078, 9315, 9318, 9319, 9388 (2); Stanf 36484, 36485, all from Bermuda, chiefly from Nonsuch Island; Field Mus. 5340, 5 (3 or 4 only), 5342, 5343, 5347 (2), 5348, 5349, and 5351 (these are part of t specimens listed by Bean as *S. mackayi*; the remaining specimens which he listed a *S. pelagicus*); all specimens are from the vicinity of Bermuda.

Diagnosis.—Dorsal fin rays 28-32; pectoral 14-15, rarely 13; anal 3; caud 10; trunk rings 16-18, usually 17; tail rings 34-38; dorsal fin covering $1\frac{1}{2}$- trunk rings and 5-$6\frac{1}{2}$ tail rings; head-in-standard length 6.2-7.5; dorsal-in-he 1.1-1.40; snout-in-head 1.75-2.0; brood pouch on first 12-13 (one=15) tail ring pectoral base-in-pectoral length 1.0-1.28; pectoral length-in-head 6.88-8.75. Max mum length 160 mm; shortest male with eggs in pouch 104 mm; groove just appeari in young male 46 mm. Depth of trunk greatly increased in most adult females, a equal to width of $2\frac{3}{4}$-$3\frac{3}{4}$ trunk rings.

Discussion and comparison.—In collections of Bermuda pipefishes, *Syngnath m. nesiotes* has often been confused with the more common *S. pelagicus*, for, wi the exception of the number of tail rings, the length of the pectoral fin, a the coloration, the two forms are very similar. These differential characters, f 109 *pelagicus*-like pipefishes, selected at random from among collections availat for examination from the Bermuda area, may be compared as follows:

	Syngnathus pelagicus				*Syngnathus mackayi nesiotes*			
Number of Specimens	1	7	33	18	7	19	17	6
Number of Tail Rings	30	31	32	33	34	35	36	37
Pectoral Base-in-Pectoral Length	1.2-1.4				1.0-1.28			
Pectoral Length-in-Head	4.6-6.6				6.88-8.75			
Coloration:								
Dorsal Fin	Often maculated in female				Always clear			
Dorso-ventral Body Stripes	Usually present in adult females				Usually absent			
	When present, are light with darker ground color				When present, are dark with lighter ground color (thi may be reversed on tail; tail-color may be same as that of *pelagicus*)			

The bimodal tail ring frequency distribution overlaps at 34; using the pe toral fin length as a criterion, the seven individuals with 34 rings break down t *pelagicus*, one, and *nesiotes*, six.

Syngnathus mackayi nesiotes is a small insular form (*nesiotes*, Gr., islan er); the largest at hand, 160 mm standard length, is well below the maximum leng

20 mm) of the mainland form, *S. m. mackayi*. At present, *nesiotes* is not known om the Caribbean. Since *mackayi* is not normally an inhabitant of Sargassum weed, is probable that the *nesiotes* population in the Bermudas is derived from main- nd individuals carried to the islands by the Gulf Stream. Table 2 shows that siotes is most closely related in meristic characters to the Panama *mackayi*. How- er, since differences in meristic characters are probably correlated with water mperature, this relationship may not be of great importance. A large number of eep-bodied females (greatest depth equal to 3-4½ trunk rings) is found in both e Bermuda and Panama forms; the *mackayi* specimens from Corpus Cristi include ewer deep-bodied females than either of the above; while specimens from Key West ow only occasional examples. (See discussion, below.)

During the examination of specimens of *pelagicus* for comparison with *nesio- s*, it became apparent that two specimens of the former species, collected by the assler Expedition at Rio de Janeiro, Brazil (MCZ 11705) were quite different from ly of the more northern representatives. As compared with the typical Caribbean rm, they differ in the much shorter head (head-in-standard length, 8.1); pectoral se-in-pectoral length 1.47; pectoral length-in-head, 5.25; and in having 16 trunk ings. Unless these individuals are aberrant, they quite probably represent an described southern subspecies of *pelagicus*, but verification and subsequent de- cription must be deferred until more specimens are available.

DISCUSSION OF THE WESTERN ATLANTIC *SYNGNATHUS*

Omitting consideration of the brood pouch, the Atlantic members of the genus *yngnathus* fall into two more or less definite groups, the V-bellied and the flat- ellied. The character of the belly-shape is most adequately shown by the adult emales. In those of the first group the belly is distinctly V-shaped, and the runk is usually greatly increased in depth (greatest trunk depth equal to width of -3½ trunk rings). The contour of the trunk in lateral aspect is typically oval. n the flat-bellied group, on the other hand, the V does not show, and the dorsal nd ventral trunk ridges are usually parallel (greatest trunk depth equal to 2-3 runk rings). The contour of the trunk in lateral aspect is therefore typically ectangular. All individuals of the flat-bellied group have flat bellies; in the -bellied group the males, immature females, and even an occasional adult female, ave flat bellies. Hence it is the adult females of the different species that may e separated by the belly character, thus:

V-BELLIED	FLAT-BELLIED
fuscus	*louisianae*
scovelli	*rousseau*
pelagicus	*springeri*
	folletti
mackayi	
floridae	*fistulatus*
dunckeri	
elucens	

The first three species listed in the V-bellied group may be termed the extreme" forms, since the trunk depth in the females shows a marked increase with ncreased body length. A number of the adult females of *S. m. mackayi*, especially

Table 2. Series of *Syngnathus mackayi*, *S. rousseau*, and *S. pelagicus* compared

Locality		*S. mackayi nesiotes*	*S. mackayi mackayi*			*S. rousseau*		*S. pelagi*
		Bermuda	Tortugas, Key West, etc.	Corpus Cristi, Texas	Panama	Panama	Carib-bean	Vari
	16	1	3	3	2		4	5
Trunk	17	32	14	18	14	17	4	51
Rings:	18	4	10		2	4		5
	19		1					
	30			1				1
	31			5				7
	32		4	9		2		33
Tail	33		4	4		10		18
Rings:	34	6	7	2		9	5	1
	35	19	11		6		3	
	36	17	2		7			
	37	6			2			
	38	1						
	27				3	2		
Dorsal	28	1			5	9		2
Fin	29	4	6		2	8	2	4
Rays:	30	2	5	2	1	2	4	7
	31	3	3	1			1	7
	32	1	3	2			1	1
	33		1	3				1
No. Tail Rings Covered by Brood Pouch:		12-13(15)	13-16	15	12-13	11-12	11-12	12-1
Maximum Standard Length in mm:		160	200-210			205		160
Pectoral Fin Base-in-Pectoral Length:		1.00-1.28	1.00- 1.23			1.30-1.60		1.20-1
Pect. L.-in-Head:		6.88-8.75	6.90-10.00			4.90-7.20		4.60-6
Head-in-Std.Length:		6.20-7.50	5.80- 7.00			7.05-8.30		5.40-6
Snout-in-Head:		1.75-2.00	1.59- 1.96			1.80-2.16		1.78-2
Dorsal Fin-in-Head:		1.10-1.40	1.15- 1.50			1.15-1.58		1.10-1

those from Key West (but not those from Panama) do not show this great increase i trunk depth, but adult females of *S. m. nesiotes*, from Bermuda, usually have thi character well developed. Therefore, *mackayi* may be considered transitional betwe the extreme V-bellied forms, the first three listed, and the "intermediate" V bellied forms, the last three listed. These latter do not show the great increas in trunk depth with increased body length: therefore, although they are V-bellied they may perhaps be considered as intermediate between the V-bellied forms and th typical flat-bellied species. (It should be remembered that *S. floridae* differ from other species of the genus in that the contacting folds of the brood pouch o the male are covered with minute papillae.) Incidentally, of all the Atlantic spe cies of *Syngnathus*, it is probable that *elucens* is the most closely related t

ythoichthys, which, in turn, is considered to be the most primitive of the Syn-thinae. In the flat-bellied series, the position of *fistulatus* must remain ettled for the present, as the only specimens (six in number) available for mination are in poor condition.

The value of dividing *Syngnathus* into V-bellied and flat-bellied species is dent when, for instance, one attempts to differentiate *pelagicus* from *rousseau*. will be noted in Table 2 that the two species are the same in most meristic racters; in addition, both have long pectorals, and often show a maculated dor-fin. They differ radically only in the maximum length of the adults (if the cimens are longer than 165-170 mm, the species is almost certainly *rousseau*). ever, since *pelagicus* is a V-bellied species and *rousseau* flat-bellied, they may separated by this character. It must be reiterated that only fully adult females uld be used for this separation, and that males and juveniles of the two species ally cannot be told apart. Slight differences in typical individuals may be onstrated if sufficient comparative material is at hand, such as *rousseau* from Field Museum or the U.S. National Museum, and *pelagicus* from the N. Y. Zoologi-Society.

Syngnathus rousseau may possibly occur in Bermuda; because of its similarity *pelagicus*, it may have been identified as that species. The author has at hand broken specimen from Bermuda which may be *rousseau*.

INTRODUCTION TO THE KEY

In order to clarify the use of certain specific names in the key, the fol-ing list of synonyms, as herein recognized, is given: *S. affinis=fuscus* with onecus locality data; *S. robertsi, walcotti, pipulus=S. elucens; S. jaumei, Cory-ichthys bermudensis=S. dunckeri; Doryrhamphus sierra, S. torrei, eigenmanni, yi, brevicaudus=Oostethus lineatus; S. jonesi, Micrognathus crinitus, C. en-adae=M. vittatus* (*crinitus* is the earlier name, but is not used since the species described as lacking the anal fin; doubtless in error, as otherwise the two cies are identical); *Amphelikturus brachyrhynchus=A. dendriticus; Corythoich-s brederi=C. albirostris; C. cayorum=C. brachycephalus; Acus heckeli, pellucl-, martinicensis=Entelurus aequoreus.*

Counts and measurements are made as follows: (1) all fin rays are counted; the first trunk ring is the ring bearing the pectoral fins, and the last is t bearing the anus; (3) the hypural ring is not included in the tail ring count; the head measurement is taken from the most anterior part of the fish, with the th firmly closed, to the posterior end of the opercular bone (care must be ex-ised in determining this latter point, and often microscopic examination is uired); and (5) the snout is measured from the tip to the posterior edge of the orbital bone.

ARTIFICIAL KEY TO THE WESTERN ATLANTIC SYNGNATHIDAE

Dorsal fin absent: (only the types known; all from Mastic Point, Andros Island, Bahamas).....*Penetopteryx nanus* (Rosen)

Dorsal fin present:

. Pectoral and anal fins absent: eggs loosely attached to the belly; no brood pouch folds, nor lateral protecting plates (known from the mid-Atlantic; American records questionable)....*Entelurus aequoreus* (Linnaeus)

2b. Pectoral present; anal present or absent:
3a. Tail prehensile (usually indicated by curled condition of tail); caudal fin absent or vestigial:
4a. Caudal fin absent; head at nearly right angle to body .....*Hippocampus*; 7 speci
4b. Caudal fin present, but vestigial; head slightly inclined from line of body (only 6 known specimens; 5 from Bermuda, 1 from Crooked Island, Bahamas).....*Amphelikturus dendriticus* Barbo
3b. Tail non-prehensile; caudal fin present:
5a. Median trunk ridge continuous over anus with superior tail ridge:
6a. Anal fin absent (only 7 known specimens; from Mindi, Canal Zone; Virgin Islands; Jamaica; Santa Cruz (?) Thayer Exped.) .....*Pseudophallus mindii* (Meek and Hildebran
6b. Anal fin present:
7a. Tail rings 49-52; mature females with accentuated rise in dorsal profile posterior to head (Chile; Peru; Eden Harbor, Patagonia; Golfo Nuevo, Chubut Terr., Argentina) .....*Leptonotus blainvillianus* (Eydoux and Gervai
7b. Tail rings 39-43; mature females with dorsal profile posterior to head nearly straight (known only from type description, Puerto Cabello, near Colon; and 6 specimens, USNM 12688, Jamaica) .....*Syngnathus fistulatus* Pete
5b. Median trunk ridge interrupted (subcontinuous) at anus, swinging dorsally from that point, and continuing caudally as superior tail ridge: (see also 5c. below)
8a. Trunk rings 23 (North Carolina and Florida; 5 known specimens) (see Table 1).....*Syngnathus springeri* Hera
8b. Trunk rings 21 or less:
9a. Dorsal fin rays (19) 21-25:
10a. Anal fin absent: (strictly an insular and semi-pelagic species; known from Bermuda, Bahamas, Cuba, Haiti, Santa Lucia, St. Kitts, Antigua, Virgin Islands, Grenadines, Puerto Rico, Curacao, Dry Tortugas, and off Cape Hatteras) .....*Syngnathus dunckeri* Metzela
10b. Anal fin present:
11a. Snout-in-head 1.90-2.2; tail rings 31-34 (known from Bermuda; Key West; Puerto Rico; Jamaica; and Curacao) .....*Syngnathus elucens* Po
11b. Snout-in-head 2.2-3.8; tail rings 24-28:
12a. Snout-in-head 2.2-2.6; dorsal fin-in-head 1.15-1.6; head-in-standard length 7.5-9.0; dorsal fin covering $1-1\frac{1}{4}+3\frac{1}{2}-4\frac{1}{2}$ rings, usually 1+4 (known from the Bahamas; Biscayne Bay, Tampa, and the keys of Florida).....*Corythoichthys albirostris* Haeck
12b. Snout-in-head 2.90-3.75; dorsal fin-in-head .96-1.20; head-in-standard length 8.4-9.8; dorsal fin covering $1\frac{1}{2}-2+3-4$ rings, usually $1\frac{3}{4}+3\frac{1}{2}$ (known from Dry Tortugas; Key West; Cuba; Puerto Rico; and Curacao).....*Corythoichthys brachycephalus* Po
9b. Dorsal fin rays 26-41:
13a. Body ridges extremely sharp, and usually equipped with saw-toothed projection in center of each ring; females flat-bellied (known only from 3 types from Uruguay) (see Table 1) .....*Syngnathus folletti* Hera

13b. Body ridges occasionally sharp, but always smooth in adults, and never equipped with saw-toothed projections; females flat-bellied and V-bellied:

14a. Snout-in-head 2.0-2.55; dorsal fin-in-head .86-1.14:

15a. Dorsal fin rays 35-43; tail rings 34-40; dorsal fin covering 4-6 trunk rings plus 4-6 tail rings; brood pouch covering 15-18 tail rings (Bay of Fundy south to St. Augustine, Florida) .....*Syngnathus fuscus* Storer.

15b. Dorsal fin rays 27-35; tail rings 30-34; dorsal fin covering 2-4 body rings and 4-5 tail rings; brood pouch covering 11-13 tail rings (Matanzas, Florida, to Corpus Cristi, Texas; one doubtful specimen from Albrolhos Island, Brazil) .....*Syngnathus scovelli* (Evermann and Kendall).

14b. Snout-in-head 1.57-2.06; dorsal fin-in-head 1.02-1.87:

16a. Tail rings 39-43; brood pouch covering 22-25 tail rings (known only from the type description, Puerto Cabello, near Colon; and 6 specimens, USNM 12688, from Jamaica) .....*Syngnathus fistulatus* Peters.

16b. Tail rings 30-38; brood pouch covering 11-20 tail rings:

17a. Brood pouch covering 17-20 tail rings; contacting folds of brood pouch covered with small conical papillae (usually visible only with aid of microscope) (Chesapeake Bay to Pensacola, Florida; not common south of Georgia) .....*Syngnathus floridae* (Jordan and Gilbert).[2]

17b. Brood pouch covering 11-16 tail rings; contacting brood pouch folds without papillae:

18a. Pectoral fin length-in-head 4.6-7.2; females often with maculated dorsal fin; flat-bellied or V-bellied species:

19a. Adult females flat-bellied; and without vertical body stripes; maximum length 205 mm (Venezuela; Panama; Jamaica; Santa Lucia; Colombia; Puerto Rico).....*Syngnathus rousseau* Kaup.

19b. Adult females V-bellied; typically with vertical light stripe in center of each trunk ring; striping usually present upon tail also; maximum length 160 mm (pelagic; usually found in Sargassum weed; common wherever it occurs).....*Syngnathus pelagicus* Linnaeus.

18b. Pectoral fin length-in-head 6.88-10.0; females always with clear dorsal fin; V-bellied species (usually found in *Zostera*).....*Syngnathus mackayi* (Swain and Meek).[2]

20a. Maximum length 160 mm; adult females with greatly increased body depth (the insular form, known only from Bermuda) (see Table 2).....*Syngnathus mackayi nesiotes* Herald.

20b. Maximum length 210 mm; some females with increased body depth, but not as marked as in *nesiotes* (the mainland form, Key West and Dry Tortugas, Florida to Panama) .....*Syngnathus mackayi mackayi* (Swain and Meek).

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the areas in which both occur, *S. floridae* and *mackayi* are often confused, r the meristic characters of the two are almost identical. Generally speaking, *oridae* has the longer head, and more rounded body edges, but this does not al-ys hold. The distinguishing character is the brood pouch—hence many females nnot be identified in the areas where the ranges overlap.

5c. Median trunk ridge confluent with inferior tail ridge; no interruption at anus:

21a. Dorsal fin rays 38-44; tail rings 23-27; brood pouch under belly (McClellanville, South Carolina, to Panama; fairly common; known from a number of the Caribbean Islands)
.....*Oostethus lineatus* (Valenciennes

21b. Dorsal fin rays 16-22; tail rings 32-39; brood pouch under tail:

22a. Anal fin absent; dorsal fin rays 16-18; rings 15-17+37-40; brood pouch covering 17-18 tail rings (Miami, Florida, to Cameron, Louisiana; Royal Island, Bahamas; doubtful data on one specimen from Albrolhos Island, Brazil)
.....*Microgнathus crinigerus* Bean and Dresse

22b. Anal fin present; dorsal fin rays 19-22; rings 17-18+32-35; brood pouch covering 14-16 tail rings (Bermuda; Puerto Rico; Albrolhos Island, Brazil; Bahia Blanca, Argentina)
.....*Micrognathus vittatus* (Kaup

THE "LUNGS" OF *BOTHRIOLEPIS*

By George S. Myers

In a recent paper on the visceral anatomy of the Devonian Placoderm, *Bothriolepis*, R. H. Denison (1941, Journ. Palaeont., vol. 15, no. 5, pp. 553-561) h described structures which he believes to be differentially fossilized remains gills, a large intestinal spiral valve, and paired air sacs connected with t pharynx by a median ventral tube. These sacs were apparently short and round and occupied the ventral anterior part of the body cavity. Denison says of the "These sacs have the same position and relationships as the lungs of certain di noans and tetrapods, and this is the most acceptable interpretation of them.. Since there is no evidence of any connection between the external nasal passag and the mouth region, it is probable that *Bothriolepis* gulped air in the same ma ner as do the present day lung fishes."

While it would be most remarkable if a Placoderm did not have gills, and t presence of a spiral valve in this group might have been suspected, the presence functional *pulmonary* organs in an Antiarchan is rather difficult to believe. Whil I have no reason to doubt Denison's facts, as observed in his sectioned materia and am ready to accept the homology (or similarity) of the sacs with the lungs the Amphiboidei, I must disagree with the interpretation of these organs as lung into which *Bothriolepis* gulped air.

Denison's description of the mode of deposition of the fresh-water sediment in which *Bothriolepis* was entombed shows that the fish lived in running rather tha stagnant water. It presumably inhabited pools, where it grubbed in the mud an nibbled algae, since its alimentary canal is filled with fine mud and carbonize matter, and in these pools was subject to periodical floods which buried some o the fishes in coarser sand.

That such a habitat must have been far richer in oxygen than the stagnan water of tropical lowlands, where the breathing of atmospheric air is develope among present-day teleostean fishes, is evident. This is a factor to be considere even though such Dipnoans as *Scaumenacia* inhabited the same rivers. The Dipnoans as Denison remarks, have shown great evolutionary conservatism, and *Scaumenaci* likely possessed lungs, but it must be remembered that the Dipnoans were a rathe

erse group and probably invaded many habitats where their lungs were not really ded. Moreover, they were not Placoderms, and one cannot adduce their mere pres- e in the habitat of *Bothriolepis* as evidence that the latter fish had or had d for lungs.

The form of *Bothriolepis* is that of a bottom fish. The underside was flat, mouth was ventral, the head and thorax were very heavily armored, and the air s, if of hydrostatic function, were too small and in the wrong dorso-ventral ition to be of much use. How a fish of such form could rise to the surface and p air without turning completely over is hard for anyone familiar with the hab- of modern fishes of similar shape to imagine. Of course, certain bottom living icariids, somewhat similar to *Bothriolepis* in form, armoring, and mouth position occasionally, rise to the surface and swim along just beneath the surface film, ide down, but they are much more lithe, light, and supple than *Bothriolepis* ld possibly have been.[1] Moreover, the heterocercal tail and the strange, cumber- e pectoral appendages would seem to have prohibited any such gyrations, to say hing of the hydrostatic and hydrodynamic difficulties involved through the form weight of the fish and the small size and ventral position of the sacs.

It is known that *Polypterus* uses its spiracles to take in air, thus avoiding ossible but more cumbersome raising of the mouth to the surface, but *Bothrio- is* had no spiracles!

What has been written of the Antiarchi leads me to believe that they were heavily armored, highly specialized end of a line of development which origi- ed from more normally shaped ancestors similar in many respects to the Acan- dians. They were specialized particularly for life on the bottoms of the larger reams, where they grubbed in the mud of deeper sections or browsed on the algae stones. Their bodies are somewhat roughly, but nevertheless plainly, adapted to h a habitat in running water, and everything that we know of the habits of pres- -day fishes of specialized form makes it seem exceedingly improbable that they e to the surface to suck in atmospheric air. Fishes of such type usually tend to uce the size of the air-bladder, since a hydrostatic organ is of distinct disad- tage to a bottom dweller who must hold his place against a current. It is my ong belief that the air sacs of *Bothriolepis*, if correctly interpreted as such, the degenerating remains of the hydrostatic or pulmonary air sacs of ancestors could and probably did use them for both purposes. That *Bothriolepis* so used m is extremely unlikely.

Consideration of the form of the Antiarchi leads one to consider the tend- y of Gregory (1936, Biological Reviews, vol. 11, pp. 311-344) and of Holmgren Stensiö (1936, in Bolk, Göppert, etc., Handb. vergleich. Anat. Wirbeltiere, n, vol. 4, pp. 242-247) to take the armored, bottom dwelling Palaeozoic Agnatha the archetypal starting point, not only for lampreys and gnathostomes, but even *Amphioxus*. They are quite right in taking the solid palaeontological evidence these recently investigated Agnatha more seriously than the somewhat nebulous unproved theories which formerly were all we had to build on, but I insist that se theories may still in large part be valid. I refer especially to the fin fold ory and to the general belief that the ancestral vertebrate and gnathostome ke were of a generalized fusiform shape.

Everything we know of the evolution of form in fishes ("the transformation organic designs," as Dr. Gregory would have it) leads inevitably to the con-

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[1] e only fishes I know which normally can and do swim upside down are Siluroid tariophysi (*Synodontis* and *Plecostomus*). Whether this excessively rare ability swim upside down has anything to do with a change of balance associated with r compensated by) the Weberian apparatus is an interesting problem.

clusion that the main piscine lines which gave rise to the known successively dif ferentiated groups held to a generalized, more or less compressed, fusiform fis shape, and I know of no instance in which it is demonstrable that heavily armored queerly shaped, specialized types gave rise to anything more than a few forms ver similar to themselves. I am perfectly willing to admit the relationship of th Cephalaspids to *Petromyzon*, and even that *Amphioxus* may be a degenerate Agnathan but I do insist that the geological record is still incomplete, and that it i quite unnecessary to assume that the actual ancestors of *Petromyzon* ever looke like *Cephalaspis*, merely because that animal is now well known.

So far as the fin fold theory is concerned, I take issue with Dr. Gregor when he calls it "an anachronism that still persists in some text-books." Moy Thomas (1939, Biological Reviews, vol. 14, p. 5) still accepts the paired fins o *Cladoselache* as the primitive Elasmobranch type. Moreover, I can see nothing in th Acanthodians to indicate that the ventral rows of spines may not have been, origi nally, the supports for just such folds as Balfour imagined, folds which may hav had their origin on the sides of a primitive, compressed-fusiform Agnathan whic gave rise to all of the fishes.